United States
Department of
Agriculture

Forest Service

Forest Pest
Management

Davis, CA

SIXTH REPORT

NATIONAL STEERING COMMITTEE FOR MANAGEMENT OF GYPSY MOTH AND EASTERN DEFOLIATORS

Healthy Forests
Make A World
Of Difference

FPM 93-15
September 1993

Pesticides used improperly can be injurious to human beings, animals, and plants. Follow the directions and heed all precautions on labels. Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides where there is danger of drift when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, if specified on the label.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S Environmental Protection Agency, consult your local forest pathologist, county agriculture agent, or State extension specialist to be sure the intended use is still registered.

FPM 93-15
September 1993

Sixth Report

National Steering Committee for Management of Gypsy Moth and Eastern Defoliators

Prepared by:

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SIXTH REPORT

National Steering Committee - Gypsy Moth and Eastern Defoliators

A Report of the Salt Lake City, UT
Meeting - August 31-September 1, 1993

September 1993

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CONTENTS

I. INTRODUCTION

A. Place and Purpose of Meeting

The 1993 meeting of the National Steering Committee for Management of Gypsy Moth and Eastern Defoliators met at Salt Lake City, UT, 31 August-1 September 1993. The meeting was hosted by Forest Pest Management Staff, Intermountain Region, with host coordination by Steve Munson and John Anhold. The purpose of the meeting was to identify FPM Technology Development Program needs and to develop the format and goals of 5-Year Tactical Plan for managing gypsy moth and eastern defoliators.

B. Attendees

John Anhold	R-4/FPM (Ogden, UT)
William Buzzard	Pennsylvania Bureau of Forestry (Middletown, PA)
Leo Cadogen	FPMI (Sault Ste. Marie, Ontario)
Harold Flake	R-8/FPM (Atlanta, GA)
Win McLane	USDA-APHIS (Otis AFB, MA)
Mike McManus	NE/FIDR (Hamden, CT)
Steve Munson	R-4/FPM (Ogden, UT)
Iral Ragenovich	R-6/FPM (Portland, OR)
Dick Reardon	NA/FHP/FCFH (Morgantown, WV)
Noel Schneeberger	NA/FHP (Radnor, PA)
Sheri Smith	R-5/FPM (Sonora, CA)
Harold Thistle	WO/MTDC (Missoula, MT)
Harry O. Yates III	SEFES/FIDR (Athens, GA)
Jack Barry	WO/FPM (Davis, CA)

II. MEMBER AND SUB-COMMITTEE REPORTS

A. Member Reports

Committee member reports are enclosed in Appendix B. Listed below are other notes and remarks made by members during the reporting session.

Harold Thistle

- MTDC is in the process of evaluating aircraft guidance systems for use in FPM operations.
- MTDC is publishing a report on block marking methods in the FS and elsewhere.
- MTDC is canvassing manufacturers and users of pheromone application equipment to evaluate the state of that art.
- MTDC has received a computer model that simulates spray drift in narrow mountain valleys.

Mike McManus

- Need to communicate well on the non-target impact needs and issues.
- There is concern over loosing Bt at some future time as a forest-use insecticide.
- Impact of gypsy moth defoliation on non-target organisms likely a much greater impact than Bt and Dimilin on non-target organisms.
- Mike has a problem in obtaining threatened, endangered, and sensitive lepidoptera for Bt screening.
- Need data on long-term effects on non-target organisms. Costs are about 150K to do a field study.
- EIS should address non-target issues.
- Gypchek work will focus on how to improve formulation - Entotech carrier looks good.

Harold Flake

- Block marking accounts for 30% of treatment costs.
- Need a spray aircraft navigation and monitoring system to improve efficacy and economics.
- There are several systems being developed by private sector.
- Considerations of a navigation system include: testing and evaluation of system for forestry use; connect to FSCBG spray model; systems capabilities and limitations; accuracy; pilot acceptance; who purchases for project; testing; and costs.
- MTDC has a project to address these considerations.
- Project needs to be well coordinated with all interested parties.

John Anhold

- Rare species of lepidoptera have been identified within the Utah gypsy moth treatment area.
- Plans to work with NE Station in conducting Bt non-target studies in the Hamden exposure tower.
- Used Dipel 6AF (water base) this year on the gypsy moth eradication project applied at one-half gallon per acre. He had to atomize larger drops due to evaporation. Dipel 6AF needs to be checked for percent volatiles.

Win McLane

- Do not use rotary atomizers to spray Dimilin.
- Noted that Pennsylvania is using Micronairs on their gypsy moth projects.
- Be alert to Dipel 4L and wettable powder formulations settling-out.
- Provided a series of reports on formulation testing that will be bound into a supplement to this report.

Dick Reardon

. Impact on aquatic organisms is the primary concern with Dimilin.

. Will add Dimilin to scope of the non-target sub-committee he chairs.

William Buzzard

. Need survey and monitoring methods for native insects including fall canker worm.

. Need non-target impact data on Dimilin applied at less than 0.25 oz/A.

Leo Cadogen

. Canada does not use Dimilin due to non-target impact.

. Having problems registering viruses in Canada.

. Canada has a target to reduce all pesticide uses 50% by year 2000.

Noel Schneeberger

. Need data on lowest effective rate for Dimilin.

. Also lowest volume for Dimilin.

. Jim Hansen's group (St. Paul, MN field office) is involved in an eradication project in Wisconsin.

. Jim expressed need for spray aircraft guidance system.

Iral Ragenovich

. Gypsy moth has been trapped in Oregon (54) and Washington (50+).

. Thompson big-eared bat is a sensitive species - impact studies being conducted summer 1993.

B. Sub-Committee Reports

Canopy Characterization (**Jeff Witcosky, Chair**). No report as Jeff Witcosky was in the field managing a canopy characterization study of eastern hardwood forests.

Swath Width (**Harold Flake, Chair**). Spray applicators are satisfied with swath specifications that are specified in R-8 contracts. There is need for a standard list of aircraft swath widths. The "how to cooperative project book" did not list swath widths; Dick Reardon stated that swath widths vary too much. Harold Flake was asked and William Buzzard volunteered to join with Tim Roland, Dan Twardus and Craig Howard to sort-out this lingering question about spray swath width recommendations. The committee asked for a report by 1 December 1993 to meet 1994 contract planning. A letter was sent to Harold Flake and Bill Buzzard on September 22, 1993 providing background and charge of the sub-committee (Appendix C-1).

Non-Target Impact (**Dick Reardon, Chair**). Dick is assembling a non-target impact database which currently contains 700-900 entries. The reader is referred to Dick's report in Appendix C-2.

C. Non-Target Impact Discussion Topics

Topics and questions are listed for future discussions and reference by gypsy moth EIS team.

- What do we now know about impact of Bt on non-target organisms? With 700-800 entries in the database - we must know how to reduce some impact?
- What species of leps are out there?
- Need to make contacts with local lepidoptera societies.
- What genus are affected by Bt?
- What are the rates and mechanisms of lepidoptera recovery in Bt treated areas?
- Are any species likely to be eliminated?
- Need to standardize field testing design, methodology and quality control.

- Need to develop strategies to reduce impact possibly through: reintroduction; reduce dose; reduce drift; reduce rates; and use other products.

- What is impact of gypsy moth on non-targets?

- Need to look at developing a model or expert system that predicts impact or lack of impact.

- Need well designed and executed field test?

- Need to debunk Bt myths eg it reproduces and is a residue problem. (If there are questions let's get a fact sheet published.)

III. NATIONAL NEEDS

A. National Needs and Priorities

The committee identified 30 technology development needs and prioritized the list by member voting. While the list may appear somewhat lengthy it documents all needs surfaced by the members including concerns about Dimilin. The list will help to develop action items within the 5-Year Tactical Plan. The needs and the number of votes each received are as follows:

- Pursue development of a risk model for impact of gypsy moth and control methods on non-target organisms. (13 votes)

- Evaluate impact of gypsy moth and eastern defoliators on forest ecosystems. (9 votes)

- Develop guidelines for surveying and monitoring non-target species. (8 votes)

- Evaluate and recommend guidance, navigation, and monitoring (GIS, GPS, and FSCBG model) systems to guide, navigate, tract, and monitor spray aircraft in real-time. (8 votes)

- Determine evaporation rates of Bt tank mixes, under different RH's, that are used to control gypsy moth. (7 votes)

- Develop efficacious pheromone formulation and delivery systems. (7 votes)

- Summarize spray canopy penetration, drift, and behavior in complex terrain, and identify data gaps. (6 votes)

- Investigate a model or expert system that predicts potential for natural collapse of gypsy moth populations. (5 votes)

- Summarize data on the Rohm Haus RH 5992 mimic growth regulator and recommend appropriate field testing. (5 votes)

- Evaluate and/or develop and recommend techniques to physically and electronically mark treatment blocks. (5 votes)

- Test gypsy moth phenology models in the West. (5 votes)

- Continue development of fungal pathogens for gypsy moth. (5 votes)

- Investigate and test Dimilin - reduced rates, reduced volumes, and anti-evaporants relative to efficacy, economy, drift, and effects on non-target organisms. (5 votes)

- Evaluate effect of Bt on non-target organisms and determine what's at risk. (4 votes)

- Evaluate efficacy and drift of insecticides applied by Rotomist, orchard air blast, and hydraulic sprayers. (4 votes)

- Develop pheromone monitoring procedures for Asian gypsy moth, Nunn moth, and pink gypsy moth. (4 votes)

- Evaluate existing data needed to determine and establish spray buffer zones. (3 votes)

- Summarize data on ultra violet degradation of Bt on foliage. (3 votes)

- Screen western foliage for potential food source of Asian gypsy moth. (2 votes)

- Evaluate registered stickers for undiluted Bt formulations in the laboratory and field. (2 votes)

- Determine ingredients in Bt formulations and evaluate effects of ingredients on non-target organisms. (2 votes)

- Develop reliable detection/collection techniques for female Asian gypsy moth hybrids. (1 vote)

- Develop monitoring techniques for specific native insects that historically reach outbreak levels. (1 vote)

- Determine existing capabilities and future needs for DNA investigation of gypsy moth hybrids. (1 vote)

- Review literature and evaluate statistical analyses methods to support non-target data evaluations. (1 vote)

B. Other Concerns and Needs

Non-target considerations - some answers are available but most remain elusive.

- What do we know about effects of Bt and Dimilin on non-target organisms?

- What are the specific data gaps and what might we need to know in the future?

- What are the components and species of the various ecosystems that we should identify and understand?

- What is the theoretical potential of eliminating a species with control activity?

- What is the recovery of organisms impacted by a control activity?

- What strategies might be used to reduce potential impact on non-target organisms?

- What is the impact of gypsy moth on various components of the ecosystem?

- How do we dispel myths within public agencies and the public that hampers sound control practices?

- How do we coordinate and manage design, support, and conduct of companion non-target impact studies in the East, West, and Canada that allow statistical comparison of result?

- How do we develop a model that predicts the potential impact of control materials and methods on non-target organisms?

C. Needs to be Discussed at Next Meeting

The following needs were identified but received no votes during the process of prioritizing the needs. These will be reviewed at the 1994 meeting.

- Determine population thresholds for cost effective treatment with Dimilin to control gypsy moth.
- Support continued research and evaluation of sterile male release technology.
- Transfer existing survey technology and evaluate adequacy of survey protocol and technology of different trapping methods.
- Review adequacy of existing ship inspection procedures.
- Transfer to the Forest Pest Management community information on biology of exotic insects that are or may be introduced.

IV. 5-YEAR TACTICAL PLAN DISCUSSION

Several hours of the meeting focused on the 5-Year tactical planning process. The committee agreed upon a format of the plan and identified goals. A draft plan will be prepared for committee review in January 1994.

A. Format - Program Elements, Goals, Rationale/Background Statements, and Actions

1. Program Elements. The following program elements within the context of managing gypsy moth and eastern defoliators were identified:

Biological Baselines and Inventory
Basic Biological and Taxonomic Information
Impact of Defoliators on Ecosystem
Monitoring and Surveying
IPM and Other Prognosis and Decision Models
Control Strategies
Insecticide and Biorational Control Materials
Application Technology

B. Goals

1. Impact on Non-Target Species

2. Availability of Control Materials

3. Management Technologies and Skills

4. Aircraft Guidance Systems

5. Information and Evaluation of Control Materials

6. Availability of Reliable Survey Methods

C. Rationale / Background Statements

A rationale / background statement will follow each goal statement. The following members agreed to develop a statement as follows:

Goal 1 (Mike McManus)

Goal 2 (Sheri Smith)

Goal 3 (Jack Barry)

Goal 4 (Harold Thistle)

Goal 5 (Win McLane)

Goal 6 (Steve Munson)

V. SUMMARY

The National Steering Committee for Management of Gypsy Moth and Eastern Defoliators met at Salt Lake City, UT, 31 August - 1 September 1993. The primary purpose of the meeting was to identify and prioritize FPM Technology Development Program needs and to develop the format and goals of a 5-Year Tactical Plan. The committee identified 30 technology development needs and reported them to the Director, FPM. Other needs, concerns, and issues were discussed and noted. We also developed a format and identified the 6 Goals for our 5-Year Tactical Plan. Thanks to all for a productive meeting.

Agenda

Draft
(8-18-93)

AGENDA

National Steering Committee -
Gypsy Moth and Eastern Defoliators
Salt Lake City, UT
31 August - 1 September 1993

August 31	Topic	Discussant
0800	INTRODUCTION	Jack Barry
	Purpose of Meeting Expectations	
	STRATEGIC PLAN - HEALTHY FORESTS FOR AMERICA'S FUTURE	Jack Barry
	REVIEW 1992 MEETING	
	Recommendations Follow-up activities	Jack Barry Members
	SUB-COMMITTEE REPORTS	
	Aircraft Swath Width	Harold Flake
	Canopy Characterization	Jeff Witcosky
	Non-Target Impact - 5-Year Plan - Impact of Biological Insecticides on Non-Target Insects	Dick Reardon
	DIMILIN - STATUS REVIEW	Win McLane
	MEMBER REPORTS AND NEEDS	Members
1700	Adjournment	
September 1		
0800	5-YEAR TACTICAL PLAN	
	Definition, Purpose, Format	Jack Barry
	Relationship to Strategic Plans	Jack Barry
	List of Projects/Tasks	Members
	Priorities and Goals	Jack Barry
	Next Meeting	Jack Barry
1700	Adjournment	

Appendix B

Member Reports

Bill Buzzard

PENNSYLVANIA GYPSY MOTH SUPPRESSION PROJECT

1993

A total of 108,717 acres of Pennsylvania forestland were treated by the Pennsylvania Department of Environmental Resources, Bureau of Forestry, during 1993 for gypsy moth (*Lymantria dispar*) suppression. Included in that total were 25,053 private residential acres, 81,943 acres of State Forest land, 602 acres of State Parks, 33 acres of federal land, and 1,185 acres in other ownerships. *Bacillus thuringiensis* (Bt) was used on 29,860 acres, while diflubenzuron (DFB) was used on 78,857 acres (all State Forest land).

As happened in 1992, the start-up of the 1993 spray season was delayed by cool, wet weather. The first reports of egg hatch were received on April 26 from Bedford, Fulton, and Allegheny Counties, but it wasn't until May 10 that spray operations got under way. The first spraying of the season occurred in Mifflin County with the application of DFB on State Forest land. The final application, which was also DFB, was made on May 26 on State Forest land in Cameron County. During that period there was only one day, May 25, when no spraying was conducted.

All Bt applications were applied undiluted using 48-BIU-per-gallon formulations--Dipel 6AF and Foray 48B. Of the 29,860 acres treated with Bt, 18,405 acres received 24 BIU per acre while the remaining 11,455 acres received 36 BIU per acre. All DFB applications were with Dimilin 4L at 0.25 ounce AI per acre diluted in water to a final spray volume of one gallon (128 ounces) per acre.

Spraying was conducted in portions of 17 of Pennsylvania's 67 counties. Ten counties, one township, and one consortium consisting of four townships, two boroughs, and one city served as cooperators for proposing and cost-sharing ($5/acre) private residential and local government-owned lands for treatment. One federal agency also cooperated at a cost of $19 per acre.

Tables 1, 2, 3, 4, and 5 provide information on the insecticide used, number of acres treated, and location of the acreage for each of five ownership categories--Private Residential, State Forest, State Park, Federal, and Other.

The 1993 project utilized eight spray aircraft and was divided into four separate contracts in three geographical areas as shown on the map on the attached project summary sheet. The aerial application contractor and subcontractors for each of the contracts were as follows:

Contract	Primary Contractor	Subcontractor
FPM 93-1	AgRotors, Inc. P. O. Box 4537 Gettysburg, PA 17325 717-334-6777	None
FPM 93-2	Tallman Aerial Spraying 1701 Peters Mountain Road Dauphin, PA 17018 717-921-2476	Michael Lavoie P. O. Box 829 Presque Isle, ME 04769 207-762-8001
FPM 93-3	Tallman Aerial Spraying 1701 Peters Mountain Road Dauphin, PA 17018 717-921-2476	Helicopter Applicators, Inc. P. O. Box 810 Frederick, MD 21701 301-663-1330
FPM 93-4	Helicopter Applicators, Inc. P. O. Box 810 Frederick, MD 21701 301-663-1330	None

Two special studies were conducted in association with the suppression project. The first of these involved a further evaluation of the feasibility of using aerial photos in conjunction with minimal balloon markers. Evaluation of this technique was started in 1992 as part of a major project designed to improve the overall efficiency of the suppression project through the use of a computer-integrated maps, photographs, and database system (CIMPADS). The 1993 study was conducted in portions of Contracts 93-1 and 93-4 in order to garner the opinions of several pilots on the technique. As expected, the pilots were unanimous in their approval of the aerial photos. Also as expected, the use of some marker balloons will continue to be required, in the near future at least, for large forested blocks lacking in distinctive physical features.

The second special study was the continuation of a separate radio frequencies study initiated in 1992. That study evaluated the use of a portable radio system supplied by the USDA Forest Service's Boise Fire Cache, Boise, Idaho, as an alternative communications system in an area of Pennsylvania where the Pennsylvania Department of Environmental Resources' radio system frequencies are frequently used by agencies in neighboring states. This year an additional repeater was used in the same general area (Contract 93-4) utilized last year. The use of three repeaters seems to have eliminated the dead spots experienced previously. However, district personnel were reluctant to use the special system, relying rather on the more powerful 100-watt DER system. Therefore, we will probably not utilize the repeaters in that area in the future but will obtain separate frequencies for use in communication between the spray aircraft, observation aircraft, and the ground crews.

Overall costs of the project have not yet been finalized. Costs for the insecticide and application contracts are shown on the attached summary. Overhead costs for the Commonwealth and the county/municipal cooperators typically add $8-10 per acre to these costs.

A comprehensive report on the project will be available upon request.

Larry D. Rhoads, Supervisor
Forest Pest Suppression Section
Division of Forest Pest Management
Bureau of Forestry
Office of Parks and Forestry
Department of Environmental Resources
Middletown, PA 17057-5021

Table 1. Private residential acreage treated - 1993.

County	District	Bt			
		24 BIU		36 BIU	
		Acres	Blocks	Acres	Blocks
Allegheny*	4	0	0	128	5
Beaver**	8	0	0	2,578	72
Bedford	2	0	0	111	4
Clearfield	9	0	0	334	19
Crawford	14	0	0	2,523	50
Elk	13	0	0	26	2
Fulton	2	0	0	231	13
Mercer	8	0	0	513	26
Pike	19	16,209	44	0	0
Tioga	16	0	0	269	1
Venango	14	0	0	348	7
Wayne	11	1,684	12	0	0
Totals (12 counties)		17,893	56	7,061	199

*Richland Township only; county not participating.

**Consortium consisting of Green, Independence, Potter, and Raccoon Townships; Big Beaver and Economy Boroughs; and the city of Aliquippa only; county not participating.

Table 2. State Forest acreage treated - 1993.

District	County	Bt		DFB	
		Acres	Blocks	Acres	Blocks
2	Bedford	390	4	0	0
3	Mifflin	0	0	882	1
5	Centre	0	0	110	1
	Mifflin	0	0	280	1
7	Centre	0	0	1,739	6
	Clinton	188	1	2,643	14
	Mifflin	0	0	127	1
9	Cameron	0	0	1,015	1
	Centre	0	0	20,705	9
	Clearfield	0	0	14,020	13
	Elk	0	0	8,460	4
10	Centre	0	0	1,625	2
	Clinton	0	0	15,625	14
13	Cameron	0	0	7,900	3
	Elk	0	0	3,726	4
16	Lycoming	164	1	0	0
	Tioga	1,832	3	0	0
19	Pike	512*	2	0	0
Totals (9 Districts)		3,086	11	78,857	74

*Bt rate = 24 BIU per acre (512 acres). All other Bt acreage (2,574 acres) will be treated at 36 BIU per acre.

Table 3. State Park acreage treated - 1993.

District	Name	County	Bt*	
			Acres	Blocks
5	Black Moshannon	Centre	415	3
8	Raccoon Creek	Beaver	126	2
14	Pymatuning	Crawford	61	3
Totals (3 Parks)			602	8

*Bt rate = 36 BIU per acre.

Table 4. Federal acreage treated - 1993.

District	Name/Agency*	County	Bt**	
			Acres	Blocks
8	Shenango River Lake-ACOEP	Mercer	33	3
Totals (1 Area)			33	3

*Cooperating agency: ACOEP = U. S. Army Corps of Engineers-Pittsburgh District

**Bt rate = 36 BIU per acre

Table 5. Other acreage treated - 1993.

District	Name/Agency*	County	Bt**	
			Acres	Blocks
8	Ambridge Reservoir/Consortium	Beaver	797	1
	Raccoon Township Park/Consortium	Beaver	20	1
	Big Beaver Park/Consortium	Beaver	92	1
	Hempfield Township Park/County	Mercer	26	1
14	Col. Crawford Park/County	Crawford	250	1
Totals (5 Areas)			1,185	5

*Cooperating agency: Consortium = Green, Independence, Potter and Raccoon Townships; Big Beaver and Economy Boroughs; and the city of Aliquippa.

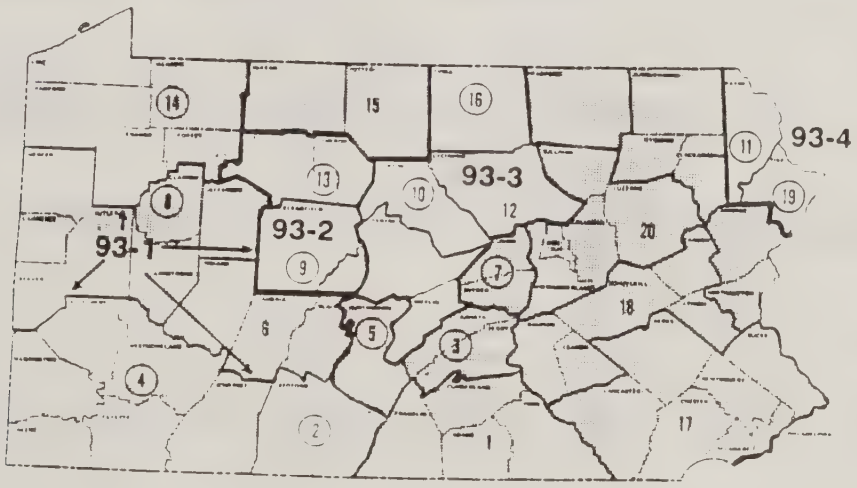
**Bt rate = 36 BIU per acre.

PENNSYLVANIA BUREAU OF FORESTRY

1993 GYPSY MOTH SUPPRESSION PROJECT SUMMARY

Acres Treated by Ownership and Insecticide

Ownership	Bt		DFB		Total	
	Acres	Blocks	Acres	Blocks	Acres	Blocks
Private	25,053	255	0	0	25,053	255
State Forest	3,086	11	78,857	74	81,943	85
State Park	602	8	0	0	602	8
Federal	33	3	0	0	33	3
Other	1,185	5	0	0	1,185	5
Totals	29,860	282	78,857	74	108,717	356



Spray Aircraft Used

Contract 93-1
2 - Bell 206

Contract 93-2
1 - Dromader M18A
1 - Thrush S2R

Contract 93-3
1 - Bell 206
1 - Bell Soloy

Contract 93-4
1 - Bell 204
1 - Bell Soloy

Start/Stop Dates

Start: May 10, 1993 (Contract 93-3, District 3, Mifflin County)
Finish: May 26, 1993 (Contract 93-2, District 13, Cameron County)

Insecticides

Bt - Dipel 6AF, 24 BIU, 64 ounces/acre undiluted (18,405 acres)
36 BIU, 96 ounces/acre undiluted (9,002 acres)
Foray 48B, 36 BIU, 96 ounces/acre undiluted (2,453 acres)

DFB - Dimilin 4L, .25 ounce AI, 1 gallon/acre diluted (78,857 acres)

DER CONTRACT COSTS - 1993 GYPSY MOTH SUPPRESSION PROJECT

Contractor	Contract	Bid Price		Acres Treated		Extra*		Actual Cost/Acre		Contract Cost		
		Bt	DFB	Bt	DFB	Bt	DFB	Bt	DFB	Bt	DFB	Total
AgRotors, Inc. Gettysburg, PA	93-1	$12.67 (36 BIU)	-	9,002	-	5	-	$12.68	-	$114,118.69	-	$114,118.69
Tallman Aerial Spraying Dauphin, PA	93-2	-	$3.49	-	55,826	-	0	-	$3.49	-	194,832.74	194,832.74
Tallman Aerial Spraying Dauphin, PA	93-3	8.98 (36 BIU)	3.97	2,453	23,031	0	0	8.98	3.97	22,027.94	91,433.07	113,461.01
Helicopter Applicators, Inc. Frederick, MD	93-4	7.78 (24 BIU)	-	18,405	-	730	-	8.09	-	148,870.30	-	148,870.30
Totals/Averages	All	$ 9.35 ($ 7.78-24) ($11.88-36)	$3.63	29,860 (18,405-24) (11,455-36)	78,857	735 (730-24) (5-36)	0	$ 9.55 ($ 8.09-24) ($11.89-36)	$3.63	$285,016.93 ($148,870.30-24) ($136,146.63-36)	$286,265.81	$571,282.74

Total Acres Treated - 108,717
Average Cost/Acre - $5.25

*Resprays and calibration adjustments--expressed as acre equivalents.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

OFFICE OF RESOURCES MANAGEMENT
BUREAU OF FORESTRY
DIVISION OF FOREST PEST MANAGEMENT
34 AIRPORT DRIVE
MIDDLETOWN, PA 17057-5021

Twenty Years of Stewardship and Service
PENNSYLVANIA DER
1971-1991

Panafax Transmittal Cover Sheet

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Brief

Comparison of Three Rates of Dimilin 25W for Gypsy Moth Suppression in Pa.

In 1992 during the Pennsylvania gypsy moth suppression project, the efficiency of two reduced rates of Dimilin 25W (.125 and .1875 oz. ai/acre) were compared with the standard operational rate of .25 oz. ai/acre.

The objective was to determine if the reduced rates of .1875 and .125 oz. ai/acre of Dimilin 25W would meet the Pennsylvania gypsy moth suppression program objectives for foliage protection and population reduction. These objectives require that defoliation of favored tree species must be kept to less than 30 percent within the treatment area while the gypsy moth egg mass population density must be reduced to the point (<500 egg masses/acre) posttreatment where retreatment will not be required the following season. The goal of this trial was to reduce the usage of diflubenzuron, thereby reducing the potential for adverse environmental impacts on nontarget organisms.

Methods:

Data was collected from a 985 acre block treated with .1875 oz. air/acre and a 450 acre block treated with .125 oz. ai/acre. Dimilin 25W was applied at a final volume of 128 oz/acre.

Results:

All three treatments provided acceptable foliage protection (Table 1). An analysis of the postspray population revealed that very comparable results were obtained from the .25 and .1875 oz ai/acre treatments, -94.5 and -91.5 percent respectively. The .125 oz ai/acre treatment resulted in a much lower population reduction, -83.7 percent.

Several major skips and misses by the applicator influenced the final results. Elimination or reduction of these application errors would have improved the results of all dosages.

A more detailed report should be available in mid-November, 1993.

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1992

Table . Population change and defoliation data for Dimilin 25W.

Treatment (Ounces AI/Acre)	Sampling Site Number	Percent Oak Defoliation	Egg Masses/Acre		Percent Change
			Prespray	Postspray	
.25	1	24	996	48	-95.2
	2	26	608	40	-93.4
	3	40	788	140	-82.2
	4	11	2,160	24	-98.9
	5	12	252	12	-95.2
x		21	961	53	-94.5
Control .25	1	85	420	576	+37.1
	2	41	668	840	+25.7
	3	69	936	246	-63.0
	4	47	648	456	-29.6
	5	74	1,300	504	-61.2
x		63	794	524	-34.0
.1875	1	53	1,928	128	-93.4
	2	41	1,734	280	-83.6
	3	12	2,084	160	-92.3
	4	15	1,924	40	-97.9
	5	10	1,192	148	-87.6
x		28	1,772	151	-91.5
Control .1875	1	56	1,800	3,628	+101.6
	2	51	1,380	764	-44.6
	3	70	1,616	1,444	-10.6
	4	59	1,540	1,692	+9.9
	5	59	2,300	2,424	+9.7
x		58	1,727	2,010	+16.4
.125	1	9	892	308	-65.5
	2	6	664	32	-95.2
	3	30	1,109	188	-83.0
	4	9	580	72	-87.6
	5	7	500	8	-98.4
x		11	749	122	-83.7
Control .125	1	17	760	998	+31.3
	2	12	672	1,504	+123.4
	3	7	884	2,100	+137.6
	4	16	476	1,262	+165.1
	5	7	1,488	2,408	+61.8
x		12	856	1,654	+93.2

Comparison of Two Rates of Dimilin 25W® for Gypsy Moth Suppression

Introduction

During the 1990 gypsy moth suppression project in Pennsylvania, the effectiveness of two reduced rates (0.04 and 0.004 ounce active ingredient/acre) of Dimilin 25W were compared against the 1990 standard rate of 0.4 ounce AI/acre. Foliage protection, but not population reduction, was achieved with a dosage of 0.04 ounce AI/acre (Buzzard et al. 1990). This suggested that an effective dosage lower than the 1990 standard dosage may exist. As a result of that study, the standard dosage for 1991 was reduced to 0.25 ounce AI/acre, the lowest recommended by the Dimilin 25W label instructions.

In 1991 we compared the efficacy of 0.125 ounce AI/acre of Dimilin 25W against the current 0.25 ounce AI/acre standard for gypsy moth suppression. The objective of the study was to determine if the 0.125 ounce AI/acre dose of Dimilin 25W would meet our gypsy moth suppression program objectives for foliage protection and gypsy moth population reduction. Those objectives state that in order for a diflubenzuron treatment to be considered successful, defoliation of favored tree species must be kept to less than 30% in the treatment area while the gypsy moth egg mass population density must be reduced to the point (<500 egg masses/acre) posttreatment where retreatment would not be required the following season. Lower dosages are more desirable in gypsy moth suppression, since less diflubenzuron would be placed in the forest ecosystem thereby reducing the potential for adverse environmental impacts on aquatic and other nontarget organisms.

McLane et al. (1978) aerially applied two applications of the 0.125 ounce AI dosage against field populations of gypsy moth larvae with good results, but single field applications of rates as low as 0.125 ounce AI have not been tried. However, laboratory tests conducted by McLane et al. (1977) support our thesis. In that study 0.125 ounce AI/acre was applied against gypsy moth larvae resulting in 97% larval mortality nine days posttreatment.

Methods

The study was conducted on 12 ten-acre sampling sites in the Tioga Forest District (District 16, Tioga County). Six of the sites were situated on six State Forest land spray blocks, and six on unsprayed State Forest land. Of the treated sites, three were established on a 974-acre block treated with 1.0 ounce Dimilin 25W (active ingredient = 0.25 ounce diflubenzuron)/acre, and three in a 1,898-acre block treated with 0.5 ounce Dimilin 25W (0.125 AI)/acre.

The insecticide was applied aerially with an Air Tractor 502 fixed-wing spray aircraft outfitted with flat-fan 8010 nozzles. The Dimilin 25W was mixed with water and sprayed at a final volume of 128 ounce/acre.

Prespray (April 1991) and postspray (October 1991) egg mass density and peak defoliation (July 1991) data were collected from each of ten 1/40-acre fixed-radius plots established within each ten-acre sampling site. Egg mass density was determined by counting all egg masses on the ground, tree boles, and crown within the 1/40-acre plots. Visual estimates of defoliation were made in 10% increments utilizing all favored-host trees greater than three inches dbh within the 1/40-acre plots.

Results

Overall, both the 0.25 and 0.125 ounce AI/acre provided acceptable foliage protection (Figures 1 and 2 and Table 1). The mean percent defoliation for 0.25 and 0.125 ounce AI/acre was 26 and 19, respectively, while the associated controls were 48 and 42, respectively. The mean percent defoliation for the 0.25 AI/acre was higher because of gaps in the spray coverage which influenced data from affected 1/40-acre sampling plots. The distribution of defoliation class occurrences for the controls on Table 2 suggests that the defoliation pressure on the 0.25 and 0.125 ounce AI/acre was similar. Chi-square tests on the defoliation class distribution (X^2 = 3.16, df = 1) indicates no difference in foliage protection between the 0.25 and 0.125 ounce AI/acre treatments at the 0.05 level. In Table 2 the two occurrences of defoliation in the >60% class for the 0.25 ounce AI/acre treatment were a result of a skip in the spray pattern.

The skips also apparently affected population reduction in the 0.25 ounce AI/acre treatment area, as indicated by the postspray egg mass density for sampling Site 3 (Table 1). Another indicator was the postseason egg mass density distribution (Table 3 and Fig. 3). The skip is represented by the anomalous occurrence of four egg mass densities greater than 750 per acre.

A comparison of the postspray egg mass density distribution of the treatments reveals a weakness in the 0.125 ounce AI/acre treatment (Table 3 and Fig. 4). A wide range of population densities remains in the treatment area, while the distribution for the 0.25 ounce AI/acre treatment is essentially limited to the <250 egg masses/acre class. Because of this difference, Chi-square tests (X^2 = 8.11, df = 2) indicate a strong difference between populations despite an actual density difference of only several hundred per acre. Despite the error in spray coverage, the population reduction is significant (X^2 = 39.33, df = 2) at the 0.05 level (Table 4) for the 0.25 ounce AI/acre treatment. The 0.125 ounce AI/acre treatment also had a significant reduction (X^2 = 38.84, df = 2) in egg mass densities. There were no significant differences (Table 5 and Fig. 4) between the prespray populations of any of the treatments (X^2 = 5.18, df = 9).

Although egg mass population reduction from NPV and other natural agents for control 0.25 and control 0.125 was 24.12% and 20.17%, respectively, Chi-square tests (Table 4) indicated the reduction was not significant (X^2 = 2.59, df = 2; X^2 = 4.54, df = 3). As expected, there was a significant difference between treatment and control (Table 5) postspray egg mass populations.

Conclusions

Even though significant population reduction (85.93%) was achieved in the 0.125 ounce AI/acre treatment, the residual posttreatment population (579 egg masses per acre) would be sufficient to qualify the area for treatment in 1992. The population reduction in the 0.25 ounce AI/acre treatment was significantly better (90.88%) and would have been even better (>95%) had not the skip in spray coverage occurred. Excellent foliage protection was obtained with both rates. However, perennial treatment of spray blocks with low dosages of diflubenzuron to achieve foliage protection alone is not desirable. Such an approach may actually result in larger amounts of diflubenzuron being introduced into the environment over time than would occur with a single application at a higher dosage.

Although the 0.125 ounce AI/acre rate was a failure in 1991 relative to our population reduction objective, the failure may be related to factors other than the low dose. Both rates were applied using the same lane separation for the spray aircraft. Since lowering the dosage lowers the concentration of insecticide in each spray droplet, it is conceivable that while 0.125 ounce AI/acre is sufficient to kill gypsy moth caterpillars, this concentration may not have been obtained in the portion of the treatment area where the edges of the spray swaths overlapped. The spray models FSCBG and AGDISP will be used to analyze this hypothesis.

Recommendations

In 1992 we plan to test the 0.125 ounce AI/acre rate again along with an intermediate rate of 0.1875 ounce AI/acre against the standard of 0.25 ounce AI/acre. The test will include application with both helicopter and fixed-wing spray aircraft and will involve a characterization of the aircraft prior to spraying.

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McLane, W. H., and J. A. Finney. 1977. Laboratory screening of candidate pesticides against the gypsy moth. USDA, APHIS, Otis ANG Base, Mass., Project Number GM 7.1.1.

McLane, W. H., and R. G. Reeves. 1978. Field studies of insecticides and microbials applied by aircraft. USDA, APHIS, Otis ANG Base, Mass. Project Number GM 8.1.2.

Table 1. Population change and defoliation.

Treatment (Ounce AI/Acre)	Sampling Site Number	Percent Defoliation	Egg Masses/Acre		
			Prespray	Postspray	Percent Change
.25	1	21	2,224	124	-94.42
	2	19	4,204	16	-99.62
	3	38	1,736	604	-65.21
$\bar{x}$		26	2,721	248	-90.88
Control	4	45	1,842	2,304	+25.08
	5	51	3,596	2,536	-29.48
	6	47	2.896	1,484	-48.76
$\bar{x}$		48	2,778	2,108	-24.12
.125	7	18	3,236	568	-82.45
	8	20	5,796	664	-88.54
	9	20	3.312	504	-84.78
$\bar{x}$		19	4,115	579	-85.93
Control	10	45	3,484	2,784	-20.09
	11	35	2,600	1,584	-39.08
	12	46	1.084	1,354	+24.91
$\bar{x}$		42	2,389	1,907	-20.17

Table 2. Number of occurrences in 1/40-acre plots of three defoliation classes for two rates of Dimilin 25W.

Treatment (Ounce AI/Acre)	Defoliation Classes[1]		
	≤30%	31-60%	>60%
.25	27	1	2
Control	2	28	0
.125	30	0	0
Control	5	24	1

[1]Based on ten samples from each sampling site.

Table 3. Distribution of egg mass densities.

Treatment	Postspray Egg Mass Density Distribution				
	<250	250-500	501-750	751-1,000	>1,000
0.25	24	2	0	2	2
0.125	5	12	5	6	2
Control 0.25	0	0	1	3	26
Control 0.125	0	1	1	2	22

Table 4. Chi^2 test for gypsy moth population reduction from two rates of Dimilin 25W.

Treatment	X^2	X^2 Distribution
.25	39.33[b]	5.991
Control	2.59[a]	5.991
.125	38.84[b]	5.991
Control	4.54[a]	7.815

[a]No significant difference.

[b]Significant difference.

Table 5. Comparison of gypsy moth egg mass population density distribution with Chi^2 tests.

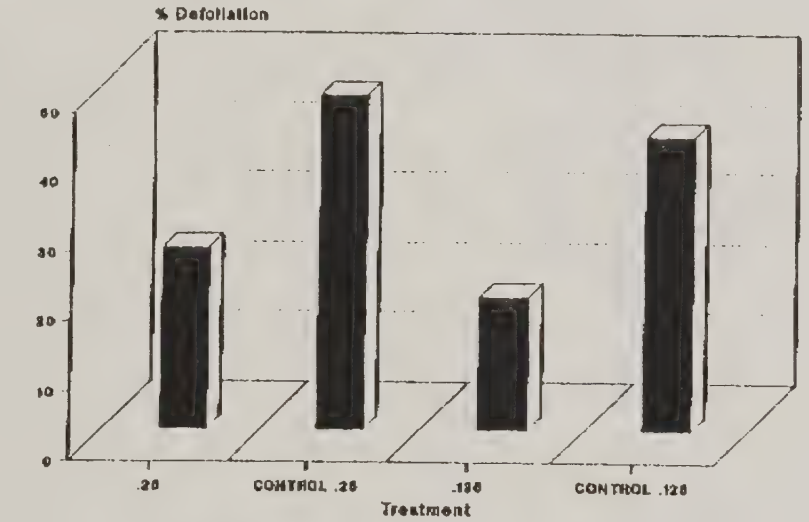
Treatment	Egg Mass Densities			
	Prespray		Postspray	
	X^2	X^2 Distribution	X^2	X^2 Distribution
.25 vs. .125	0.66[a]	5.991	8.11[b]	5.991
.25 vs. Control	0.00[a]	5.991	36.26[b]	5.991
.125 vs. Control	1.75[a]	5.991	12.54[b]	5.991
Control vs. Control	3.04[a]	7.815	18.57[b]	7.815

[a]No significant difference.

[b]Significant difference.

Figure 1

COMPARISON OF FOLIAGE PROTECTION FROM TWO DOSAGES OF DIMILIN 25W



Treatment = oz. active ingredient per acre

Figure 2

OCCURRENCES OF DEFOLIATION CLASSES FOR TWO DOSAGES OF DIMILIN 25W

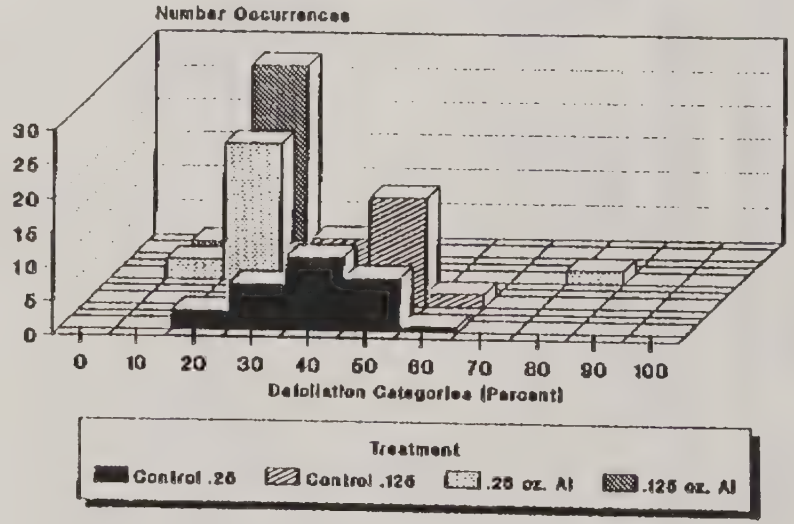
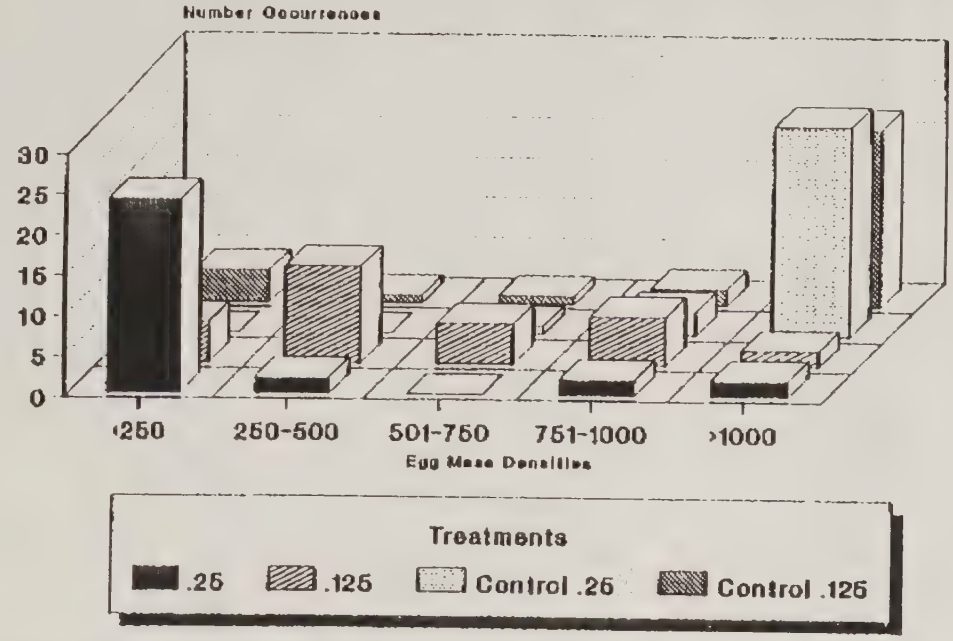


Figure 3

POSTSPRAY DISTRIBUTION OF EGG MASS DENSITIES FOR TWO DOSAGES OF DIMILIN 25W



Number occurrences = the number of 1/40 acre plots

Figure 4

PRESPRAY DISTRIBUTION OF EGG MASS DENSITIES FOR TWO DOSAGES OF DIMILIN 25W

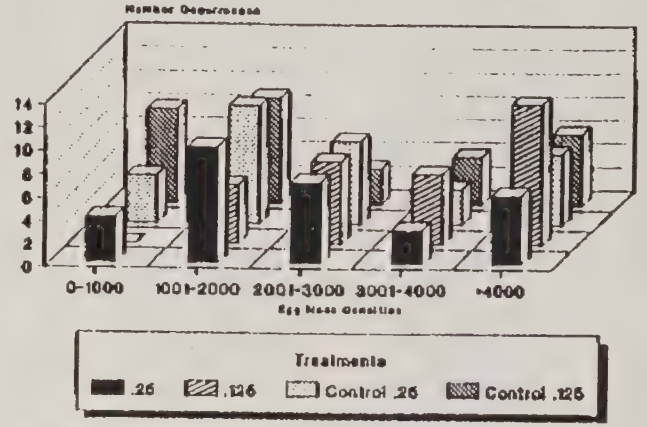
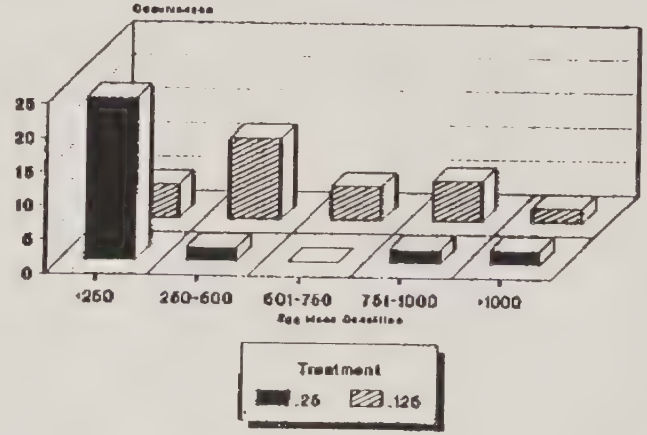


Figure 5

DISTRIBUTION OF POSTSPRAY EGG MASS DENSITIES



Comparison of Three Dosages of Dimilin 25W® for Gypsy Moth Suppression

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Comparison of Three Dosages of Dimilin 25W® for Gypsy Moth Suppression

The aerial application of Dimilin 25W to suppress populations of gypsy moth, Lymantria dispar (L.) (Lepidoptera: Lymantriidae), has historically been used on uninhabited publicly owned forestlands in Pennsylvania to protect timber and recreational values. Since these lands have an abundance of fresh-water streams, much attention has been focussed on the impact of Dimilin's active ingredient, diflubenzuron, on aquatic and other nontarget organisms.

Until 1990 Dimilin was routinely applied on qualifying acreage in Pennsylvania at .5 ounce ai/acre in a final spray volume (2.0 ounces Dimilin 25W in 128 ounces of water) of 128 ounces/acre. The dosage was reduced in 1990 to .4 ounce ai/acre to further reduce the potential for environmental impacts. At the reduced rate, foliage protection and population reduction were equivalent to the .5 ounce ai/acre (SBE 1989 and 1990).

These results suggest that the previously used .5 ounce ai/acre rate may have been unnecessarily high. Perhaps lower dosages could provide the desired foliage protection and population reduction while reducing impacts on nontarget organisms. Neither McLane (USDA, APHIS) nor Shadbolt (Uniroyal Chemical Company, Inc.) (personal communication) are aware of any efficacy studies on gypsy moth using dosages of Dimilin less than .25 ounce ai/acre.

For 1990 a study was conducted to compare the effectiveness of two reduced dosages, .04 and .004 ounce ai/acre, against the now-standard dosage of .4 ounce ai/acre relative to foliage protection and gypsy moth population reduction.

Materials and Methods

The study was conducted on 12 blocks of 50 acres each in the Moshannon State Forest (see map) on a plateau with northern red and white oaks (Quercus rubra L. and Q. alba L.) as the dominant tree species. To reduce the edge effect, a ten-acre subblock was established for data collection purposes within each 50-acre block. Pre- and postspray egg mass density and peak defoliation data were collected from ten 1/40-acre fixed-radius plots established within each subblock. Egg mass density was determined by counting the egg masses within the 1/40-acre plots on the ground, tree bole, and crown. Visual estimates of defoliation in 10 percent increments were also made within the 1/40-acre plots utilizing all trees greater than three inches dbh.

Dimilin was applied aerially with an Air Tractor 502 outfitted with D8-45 nozzles. The material was sprayed at dosages of .4, .04, and .004 ounce ai/acre at a rate of 128 ounces/acre. Each treatment and control was replicated two times.

Results

The .4 and .04 ounce ai/acre treatments resulted in no defoliation, while the controls had mean defoliation of 55 percent and 45 percent, respectively (Table 1). But the distribution of defoliation class occurrence for the control on Table 2 suggests that defoliation pressure may not have been as severe in the .04 ounce ai/acre treatment block. There were more sample points moderately defoliated than heavy. Although defoliation protection did not occur in the .004 ounce ai/acre treatment, defoliation class distribution may indicate a slight treatment effect. The treated block had more sample points with 31-60 percent defoliation class and less in the greater-than-60-percent class.

As expected, a population reduction occurred in the .4 ounce ai/acre treatment. The mean egg mass density/acre was reduced from 5,440 to 20 which was significant at the 5 percent level (Table 3). The effects of the .04 and .004 ounce ai/acre treatment (Tables 1 and 3) were masked by an apparent NPV epizootic with larvae/pupae exhibiting the classic symptoms. An analysis of variance revealed no significant difference for population reduction (Table 3) between treatments and controls for both the .04 and .004 ounce ai/acre treatment.

Discussion

As mentioned, an apparent NPV epizootic complicated the analysis of the data throughout the treatment areas particularly the .04 and .004 ounce ai/acre treatments. Although there are indications of foliage protection and population reduction with the .004 ounce ai/acre treatment, the epizootic sufficiently masked any treatment effect.

Although excellent foliage protection was provided in the .04 ounce ai/acre dose treatment areas, the NPV epizootic may have had a positive effect on the results. In healthy gypsy moth populations, this dosage may be inadequate.

Neither .04 or .004 ounce ai/acre provided acceptable population reduction, since posttreatment EM/A densities were sufficient to warrant treatment the following season. However, the results for .04 ounce ai/acre were better than expected with regard to foliage protection. This suggests that there may be an effective dosage lower than the standard .4 ounce ai/acre. Future efforts should be directed at testing dosages greater than .04 but less than .4.

Acknowledgement

We express our gratitude to Dr. Glen Stanosz of our division for providing instructions on the use of the statistical software Minitab.

Table 3. Analysis of variance for gypsy moth population reduction from various dosages of Dimilin 25W.

Treatment (Ounce AI/Acre)	Block Number	Egg Mass Density								
		Prespray			Postspray			Percent Change		
		$F^{1,2}$	LSD	Mean	$F^{1,2}$	LSD	Mean	$F^{1,2}$	LSD	Mean
.4	1	6.59	3013	7404[b]	8.92	280	20[a]	10.16	.143	.9955[b]
	2			3476[a]			20[a]			.9923[b]
Control	3			1188[a]			280[a]			.8008[a]
	4			2496[a]			632[b]			.6706[a]
.04	5	.98	-	1972	2.13	-	248	.17	-	.7902
	6			2348			448			.7765
Control	7			1916			412			.8259
	8			2980			648			.7803
.004	9	2.25	-	3024	0.80	-	776	3.76[3]	-	.6812
	10			3168			484			.8711
Control	11			1940[1]			664[1]			.6218
	12			1416			608			-.1591

[1] $F_{3,36}$ at .05 = 2.63.

[2] df = 3.

[3] Exceeded $F_{3,36}$ at .05 because of an increase in egg mass counts from prespray to postspray on three 1/40-acre plots in Block 12.

[a] No significant difference based on the least significant difference (LSD) value.

[b] Significant difference based on the LSD value.

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Leo Cadogen

Report to the National Steering Committee for Management of Gypsy Moth and Eastern Defoliators

Salt Lake City, Utah, Aug 31 to Sep1 1993

Compiled by B.L. Cadogan
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The following are preliminary summaries of research relating to the management of Gypsy moth and other eastern defoliators that was conducted at FPMI during 1992-1993.

Inquiries should be directed to the relevant principle researchers.

Management of Gypsy Moth

Principle Researcher : Gary G. Grant - Monitoring Gypsy Moth Populations with Pheromones

Research was conducted in conjunction with John Cunningham's 1993 virus spray trials (see below) to investigate a pheromone -based population monitoring system for gypsy moth. The system is aimed at correlating trap catch (moths) with other measures of population levels, in particular the number of eggs per hectare; but also the number of pupae per burlap band and the percentage defoliation. The research also intends to examine and describe the association between trap catch in the treatment and check plots and to experiment with trap design and lure formulation to limit the number of moths in traps and thus avoid trap saturation.

Principle Researcher: J.C. Cunningham - Aerial Spray Efficacy Trials with a Cyanamid Formulation of Gypsy Moth NPV and Foray 48B in 1993

Cooperators: K.W. Brown, N.J. Payne, G.G. Grant, R.E. Mickle, R.A. Fleming, A. Robinson, R.D. Curry, D. Langevin and T. Burns.

Three NPV treatments and one *Bacillus thuringiensis* treatment were replicated on five 10 ha plots and a further five 10 ha plots were monitored as untreated check plots. Plots were located on Crown Land in Ontario Ministry of Natural Resources Bancroft District in Methuen Twp. Plots were 210 x 480 m giving an area of 10 ha. They were in three distinct geographical localities and there was a buffer zone of at least 500 m between plots. All plots contained a minimum oak component of 30%. Mainly red oak is found in this area, although some white oak is also present. Spraying commenced on May 21 with NPV when all gypsy moth larvae were in their first instar and finished on June 2 with *B.t.* when 24% were first, 63% were second and 15% third instar. All applications were made using the FPMI Cessna Agtruck equipped with 4 AU 4000 Micronair units adjusted to rotate at 5,000 r.p.m. at a flying speed of 176 km/h. Treatments were as follows:

1. A double application of the Cyanamid W.P. formulation with an optical brightener as a virus adjuvant at a dosage of 5 x 10^{10} PIB/ha giving a total of 10^{11}PIB/ha. Volume application rate was 5.0 L/ha. The two applications on May 21 and May 26 were 5 days apart.

2. A single application of the Cyanamid W.P. formulation with optical brightener at 5 x 10^{10} PIB/ha in 5.0 L/ha on May 22.

3. A single application of Cyanamid W.P. formulation with optical brightener at 10^{11} PIB/ha in 5.0 L/ha on May 23.

4. A double application of Foray 48B in 2.4 L/ha giving 30.0 BIU/ha at each treatment. Sprays were 3 days apart on May 30 and June 2.

A detailed assessment was conducted. Deposit was monitored at 6 sites in 2 of the 5 replicates for each treatment. At each sampling station, halyards were placed in oak trees at 3.0 - 4.5 m and at 7.5 - 9.0 m and used for mounting artificial leaves cut from polypropylene sheet and Kromekote cards. Actual foliage was sampled at the same heights and a Kromekote card and stainless steel sheet were placed on a polystyrene board on the ground. Pre-spray egg mass counts were made on twenty 0.01 ha sub-plots in each treated and each check plot and post-spray counts will be made in late October. Burlap traps were put on 3 oak trees in each of the twenty 0.01 ha sup-plots and pupae were counted in these traps. Defoliation estimates were made on 100 45-cm oak branch tips from each plot. Three pheromone traps with reduced amounts of lure were placed in each treated and each check plot.

Preliminary analysis of data indicates that all 4 treatments were effective in protecting foliage compared to untreated check plots. The average of the pupal counts were lower in treated plots than the check plots, but there were wide ranges between replicates and differences were not statistically significant ($p>0.05$). There was a good correlation between pupal counts and an interim catch of male moths in pheromone traps ($R^2=.64$). Deposit analysis is incomplete and fall egg mass counts are required to complete this study.

Principle Researchers: K.N. Barber, W.J. Kaupp, S.B. Holmes - Specificity Testing for Nuclear Polyhedrosis Viruses of Gypsy Moth and Eastern Spruce Budworm.

Host range of specificity testing of microbial insecticides is a requirement for registration in Canada. To date, about forty-six species of caterpillars representing nine families of Lepidoptera and adults of the parasitic fly, *Cyrtophleba coquilletti* Ald. (Diptera: Tachinidae),have been assayed with *Lymantria dispar* NPV (*Ld*NPV) and determined to be non-permissive. About eighteen species (including *Choristoneura conflictana* (Wlk.)), representing six families of Lepidoptera, have been assayed with *Choristoneura fumiferana* NPV (*Cf*NPV) and determined to be non-permissive while definitive cross-infections were demonstrated in three other species of *Choristoneura* (*C. pinus pinus* Free., *C. occidentalis* Free., *C. rosaceana* (Harr.)). In addition, adult males of the alfalfa leafcutter bee, *megachile rotundata* (Fabr.) (Hymenoptera: Megachilidae) have also been determined to be non-permissive of both *Ld*NPV and *Cf*NPV.

Management of Spruce Budworm & Other Defoliators

Principle Researchers: B.L. Cadogan, A. Retnakaran, N. Payne & J. Meating - Experimental Field Trials with Mimic 2F (RH5992) to Control Spruce Budworm.

Small scale experimental field trials (pilot tests) were conducted during the spring and summer of 1993 to determine the efficacy of Mimic 2F (RH5992) and investigate the effectiveness of six dosage (AI/ha), spray volume (L/ha) treatment strategies against spruce budworm *Choristoneura fumiferana.*

The research was conducted in Northern Ontario, Canada using 60 to 75 ha blocks (each with five 10- ha plots) for the treatments and eight 5- ha randomly selected as checks.

The treatments were prepared by diluting the product (240 g AI/L) in water (Table 1)

Table 1 Mimic 2F (RH5992) treatments in 1993. (N. E. Ontario, Canada)

Treatment/ha			Tank Mix Concentration		Flow Rate
AI (g)	Spray Volume (l)	No of Applications	Mimic : Water (ml)		(L/min)
35	2.0	1	72.5:927.5	(1:12.8)	24
70	1.0	1	290:710	(1:2.45)	12
70	2.0	1	145:855	(1:5.90)	24
70	2.0	2	145:855	(1:5.90)	24
70	4.0	1	72.5:927.5	(1:12.8)	48
140	4.0	1	145:855	1:5.90)	48

and dyeing the mix with Rhodamine WT red dye (0.2% w/v). The FPMI Cessna Agtruck fitted with four Micronair AU4000 rotary atomizers applied the material flying approximately 15 m above the forest canopy at 176 km/h. The atomizer blades were pitched at 50^0 or 55^0, (depending on the application flow rate) primarily to achieve cage rotations of approximately 4500 RPM when spraying. These RPMs were predicted (using wind tunnel data generated in New Mexico) to generate droplet sizes (between 90 and 150 μm) at the target site. Because of the high evaporative water content of the tank mixes (Table 1) the sprays were all applied early on mornings (between 05:45 and 08:00 h) under ≥75% R.H.

The sprays were timed to target 4^{th} instars when the shoots of the balsam fir host trees (*Abies balsamea*) were flushed and flared.

At the time of writing the data analyses were incomplete. Nevertheless, preliminary and cursory observations of the treated and check plots seem to indicate that treatments using 70 g AI sprayed in 2 L per ha might be the most efficacious of the six strategies.

Principle Researchers: B.V. Helson, B. Lyons, M. Isman and J.T. Arnason, - Development of Natural Products for Forest Pest Management.

The primary objective of this ongoing research is to identify promising natural products and assess their potential for forestry use.

Commercial and experimental formulations of Neem (azadirachtin) from the neem tree, *Azadirachta indica*, are being evaluated against several pests, including spruce budworm, eastern

hemlock looper, gypsy moth, forest tent caterpillar, black army cutworm, pine false webworm, European spruce sawfly, mountain ash sawfly and white marked tussock moth.

Tull oil, a byproduct of the softwood kraft-pulping industry, is also being screened for activity in many of the above species.

Principle Researchers: B.V. Helson, Mamdouh Abou-Zaid and J.T. Arnason, - The Mechanism for Resistance of Red Maple to Forest Tent Caterpillar Larvae.

The objective of this study is to identify and define the apparent resistance mechanism in red maple leaves to feeding FTC larvae.

Studies conducted in 1992-1993 concentrated on food preferences, to better understand interactions between FTC and red maple, compared to a preferred host, sugar maple. The secondary chemistry of the sap from these maple species is being elucidated and the biochemical basis of resistance in red maple is being identified through bioassay - driven fractionation.

Principle Researcher: K.M.S. Sundaram, - Photostability & Rain-Washing of Mimic®, RH-5992 from Balsam Fir Foliage Following Application of Two Formulations

Two formulation concentrates of the insecticide, RH-5992 [N'-t-butyl-N'-(3,5-dimethylbenzoyl)-N-(4-ethylbenzoyl) hydrazine], an aqueous flowable (2F) and an emulsion-suspension (ES), were diluted with water to provide three spray mixes at 35, 70 and 140 g of the active ingredient (AI)/ha respectively. The mixes were sprayed in a laboratory chamber onto balsam fir branch tips collected from field trees and greenhouse-grown seedlings. Droplet size spectra and spray mass recovery were determined on artificial samplers. Simulated rainfall of two different intensities, was applied at different rain-free periods, and rain droplet size spectra were determined. Foliar washoff of RH-5992 was assessed after application of different amounts of rain, and the increase in soil residues was evaluated. Balsam fir branch tips were exposed to simulated sunlight of two different intensities at different intervals of time, and the emission intensity spectra were measured. The photostability of RH 5992 was assessed after different periods of exposure.

A direct relationship was indicated between the amount of rainfall and RH-5992 washoff. The larger the rain droplet size, the greater the amount washed off. Longer rain-free periods made the deposits more resistant to rain. Regardless of the amount of rainfall, rain droplet size and rain-free period, foliar deposits of the 2F formulation were washed off to a greater extent than the ES formulation. The increase in soil residues due to foliar washoff was greater for the 2F than for the ES formulation. The deposits of the emulsion-suspension were consistently more resistant to rain-washing than those of the aqueous flowable formulation. A direct relationship was indicated between the intensity of radiation and RH 5992 disappearance from foliage. The longer the duration of exposure to radiation, the greater the disappearance. Unlike the rain-washing, the radiation-free period (i.e., the time interval between RH 5992 treatment and the onset of exposure to radiation) failed to influence the disappearance of RH 5992 from foliage. The data thus indicated that ageing of foliar deposits had little influence on photo-induced disappearance of

RH-5992. Regardless of the amount of cumulative radiation, radiation intensity and radiation-free period, foliar deposits of the ES formulation disappeared to a greater extent than the 2F formulation. Once again, this behaviour was probably due to the presence of a lipophilic material in the ES formulation which caused the droplets to spread more than the 2F formulation, thus providing a greater surface area of exposure for the RH-5992 particles. Consequently, the amount of RH-5992 disappeared was greater for the ES formulation than for the 2F formulation.

Principle Researcher: K.M.S. Sundaram, - Adsorption Behaviour of RH-5992 Insecticide Onto Sandy and Clay Loam Forest Soils.

Adsorption-desorption behaviour of RH-5992 [Mimic®], in sandy and clay loam forest soils was studied using the batch equilibrium method. Adsorption was higher in the clay loam soil than in the sandy loam. Adsorption increased linearly with RH-5992 concentration and decreased with increasing pH and temperature. The adsorption data fitted better in the Freundlich, than in the Langmuir equation. The K_D (linear adsorption constant) and K_F (Freundlich constant) were similar for each soil at 5, 15 and 25°C and decreased with increase of temperature, indicating that the enthalpy of adsorption is negative. The exponent of the Freundlich equation was close to unity for both soils at all three temperatures. The low E_a (energy of activation) indicated a diffusion-controlled process during the initial stages of adsorption. Desorption isotherm differed from that of adsorption, and the linear desorption constant, $K_{D(d)}$, was nearly 25 times higher than the K_D, indicating that adsorption of RH-5992 is not readily reversible. Evaluation of thermodynamic parameters confirmed the presence of strong bonds between the solute and soil. These findings suggest that RH-5992 has a limited potential for downward mobility leading to groundwater contamination.

Principle Researchers: K.M.S. Sundaram, A. Sundaram, S.J. Gee*, R.O. Harrison, B.D. Hammock* - Enzyme-linked Immunosorbent Assay for Quantification of *Bacillus thuringiensis* var. *kurstaki* Crystalline Protein in Commercial Formulations, in Relation to Total Protein and Insecticidal Activity**

The widespread use of microbial pesticides for forest insect control necessitates determination of the delta-endotoxin protein levels in commercial formulations to optimize their use-patterns in the field. Because the analyte is biochemical and/or biological in nature, classical analytical procedures are often not applicable for this purpose, and new types of analytical methods need to be developed. A sandwich type enzyme-linked immunosorbent assay (ELISA) was developed to detect and quantify *Bacillus thuringiensis* var. *kurstaki* delta-endotoxin in nine commercial formulations used for forest insect control in North America. Formulation ingredients (formulants) interfered with the toxin response in three of the nine formulations, and the total protein was separated from formulants for ELISA. Total protein levels were consistently higher (about 40 to 60%), in all formulations than the delta-endotoxin content because of the presence of inactive proteins. Results of three types of force-feeding bioassays [using spruce budworm, *Choristoneura fumiferana* (Clemens.)] *viz.*,with diluted 'whole' formulations (WH-FORM), formulation extracts (EX-FORM), and redissolved protein precipitates (RP-FORM), showed that the formulants contributed to bioactivity and had to be removed to assess toxicity of the BTK

protein alone. The delta-endotoxin content of formulations correlated better with the LD_{50}'s (ng total protein/larva required for 50% mortality) of the RP-FORM than with those of the WH-FORM and EX-FORM. As more microbial pesticides are being introduced for forest insect control, it is crucial that analytical methods are in place for quality control of commercial formulations, both from the standpoint of improved efficacy and environmental safety.

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Principle Researchers: K.M.S. Sundaram and J. Curry, - Initial Deposits and Persistence of Azadirachtin in Fir and Oak Foliage After Spray Application of Margosan-O® Formulation

Foliar deposits and persistence of azadirachtin were investigated after spraying Margosan-O® formulation at three dosage and volume rates on to balsam fir and oak seedlings in a laboratory chamber. Droplet size spectra and deposits were assessed using artificial samplers, and foliar residues were measured by high-performance liquid chromatography (HPLC) at different intervals of time after treatment. Disappearance of azadirachtin from both types of foliage was rapid, and the DT_{50} (the time required for 50% of the initial concentration to disappear) values ranged from 17 to 22 h. The initial azadirachtin concentrations varied widely from 4 to 96 $\mu g\ g^{-1}$ (fresh weight), but the rate constants, 0.0311 to 0.0414, were not significantly different. The data thus indicated a poor relationship between initial concentrations and the rate of loss.

The influence of spray droplet size and cuticular wax content of foliage on persistence of azadirachtin was investigated using both foliar types, and glass microscope slides without and with the foliar wax coating. Neither the type of surface, nor the droplet size influenced the persistence. The rate of azadirachtin loss from the glass slides was faster than from both types of foliage, and was unaffected by the presence of wax coating. The fir foliage contained higher cuticular wax content than the oak foliage, but the persistence of azadirachtin was similar in both foliar types.

Principle Researchers: Kanth M.S. Sundaram and Alam Sundaram, - Influence of Drop Sizes of Deposits on Persistence of *Bacillus thuringienses* var. *Kurstaki* in Oak Foliage

Uniform drop sizes ranging in diameters from 42 to 250 μm of Foray® 48B, a commercial formulation of *Bacillus thuringiensis* Berliner var. *kurstaki* (BTK), were applied onto foliage of oak seedlings. The amount of BTK international units (IU) applied on 1.0 cm^2 foliar area was computed using the total number of drops/cm^2, volume of each drop, total volume of Foray 48B used, and the IU per unit volume of the formulation. To study the persistence, leaves were clipped from treated seedlings at 1.0, 12, 24, 48, 72, 96 and 120 h after treatment, and placed in an alkaline buffer to extract the toxic protein. Aliquots of extracts were used for force-feeding bioassay using 4th-instar gypsy moth larvae. The mean half-lives of BTK inactivation (DT_{50}, the time for 50% of the initial activity to disappear) in foliage were about 26 h for the largest drops

(250 μm), and about 12 h for the smallest drops (42 μm). The DT_{50}'s for the 42 and 73 μm drops were significantly lower than for the 103 and 132 μm drops, which in turn were markedly lower than for the 160 to 250 μm range. An upper limit in the 130 to 160 μm range was indicated beyond which the rate of inactivation was independent of drop sizes applied.

The reason for the slower rate of inactivation when BTK was present in an agglomerated form in a few large drops as opposed to in a disintegrated form in several small drops, seems to lie in the surface area of drop deposits exposed to sunlight in the greenhouse. The amount of BTK in one 250 μm drop is equivalent to the amount in 210 drops each of 42 μm. This means that the probability of exposure to light is much greater for deposits made up of several 42 μm drops than for those of a single 250 μm drop. Thus the study pointed out the importance of drop sizes of deposits on sunlight-mediated inactivation on oak foliage.

Principle Researcher: A. Sundaram, - Drop Size Spectra and Deposits of *Bacillus thuringiensis* Formulations on Simulated and Natural Balsam Fir Foliage Under Laboratory Conditions

Four aqueous formulations of *Bacillus thuringiensis* var. *kurstaki*, containing a dye and a chemical tracer [triethyl phosphate (TEP)], were sprayed in a laboratory chamber over balsam fir branches clipped from field-grown trees. Spray was also applied on aluminum fir branches (similar in size, shape and surface characteristics to the natural forests) with and without a coating of the cuticular wax extracted from natural fir foliage. Drop size spectra, drops/cm^2, and deposits (ng TEP/cm^2 of foliar area, and ng formulation protein/cm^2) were assessed on the natural foliage and wax-coated aluminum foliage (foliar simulator); but only drops/cm^2, and deposits of TEP and protein were measured on the bare aluminum foliage. Both natural foliage and the foliar simulator received similar drop sizes, drops/cm^2 and deposits, but the latter two parameters were higher on the bare aluminum foliage. The investigation provided a new method to determine the actual drop sizes deposited on a foliar simulator.

Principle Researchers: A. Sundaram, J.W. Leung & B.N. Devisetty, - Rainfastness of *Bacillus thuringiensis* Deposits on Confier Foliage

Eight oil-based and four aqueous experimental formulations of *Bacillus thuringiensis* var. *kurstaki*, were sprayed in a laboratory chamber over potted seedlings of white spruce and balsam fir. Foliar deposits were assessed before and after 3 mm rain with a rainfall intensity of 5 mm/h, by a force-feeding foliar extracts to spruce budworm larvae. A total-protein assay method was used to compare the two sets of results. The force-feeding bioassay method showed that formulations that provided high initial deposits on foliage, showed some residual activity after the rainfall, whereas formulations that provided low deposits showed no activity after the rain. This trend was observed regardless of the formulation type, oil-based or aqueous. The total-protein assay method was more sensitive than the force-feeding bioassay method because with all formulations, some protein deposits (ng/cm^2) remained on foliage after the rain. In general,

the oil-based formulations showed greater rainfastness than the aqueous formulations, a finding that was not as evident in the force-feeding bioassay method. The force-feeding bioassay method depended upon the biological response of the insect, resulting in a high variability in deposits, whereas the total-protein assay method provided a direct estimation of protein deposits that were independent of the insect response to the toxin. Consequently, the results were less variable.

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Principle Researchers: A. Sundaram, K.M.S. Sundaram, J.S. Zhu,* R. Nott, J. Curry and J.W. Leung, - Spread Factor, Penetration Depth and Stain Height of Drops of Aqueous Pesticide Mixes on Kromekote® Cards

Spreading behaviour of water-based pesticide drops ranging from 50 to 450 μm in diameter was studied on Kromekote® cards (K-cards), using spray mixes of five chemical insecticides, and three commercial formulations of *Bacillus thuringiensis* var. *kurstaki* (BTK). Spread factors (SF, the ratio of the stain diameter 'D' of a drop on the card to the spherical diameter 'd' of the drop making the stain) ranged from 1.0 to 4.5. The investigation on the role of drop size on SF, h_P (the penetration depth) and h_E (the stain height), showed that drops of the chemical insecticides underwent complete spreading and penetration into the card with no h_E above the card surface, and that both SF and h_P increased with drop size. The mixes of BTK underwent only partial spreading. The smaller drops (50 to 150 μm) of Dipel® 6AF and Thuricide® 48LV, were spherical, but the medium ones (150 to 300 μm) provided spherical segments, and the larger drops (300 to 450 μm) formed flattened cylinders. All BTK drops showed h_E but not h_P. The drops of Foray® 48B (50 to 450 μm) formed spherical segments with both h_P and h_E. The impaction energy of all drops increased dramatically with 'd', whereas the SF, h_P and h_E increased only gradually.

Spread factors of the chemical insecticide mixes increased gradually as the water proportions decreased and the ingredient concentration increased. With the most concentrated mix (no water), SF increased dramatically. All drops of Dipel 6AF and Thuricide 48LV remained spherical, despite the higher concentration of ingredients; but those of Foray 48B formed spherical segments and showed a decrease in SF at higher concentrations.

All drops of the BTK mixes took only 30 to 120 min for maximum spreading, whereas those of the chemical insecticides (except the most concentrated mixes) took 24 to 48 h. The most concentrated mixes continued to spread until 16 d after impaction, and no increase in SF was noted afterwards. Regardless of the concentration levels, all drops showed 'finite' SF values, whether they were from chemical or BTK mixes. Even the most concentrated mixes did not continue to spread indefinitely, a finding in contrast to the one observed previously for drops of non-volatile, oil-based mixes.

Harold Flake

Gyspy Moth R-8

Eradication and Suppression Projects

In 1993 a total of 93,000 acres were treated in Virginia, North Carolina, Tennessee, Georgia and Arkansas in gyspy moth suppression and eradication programs in Region-8. Dimilin was used to treat 50,000 acres. Bacillus thuringiensis (Bt) was used on 40,000 acres, GYPCHEK was used to treat 500 acres and 2,500 acres were treated with DISRUPT II pheromone flakes. The majority of the acreage treated involved suppression efforts in northern Virginia.

Eradication projects were conducted in Tennessee, Georgia and Arkansas. The Georgia Forestry Commission treated 1,937 acres with Bt in the second year of the White County Gypsy Moth Eradication project. The infestation found in 1991 was first treated in 1992 and again this year. Post-treatment evaluations indicate the treatment was successful in eliminating populations from the spray area. To date, no moths have been trapped in the county. The Tennessee Department of Agriculture (TDA) was involved in two eradication projects. In Johnson County 840 acres were treated with Bt. A smaller infestation of 155 acres in Sequatchie County was treated with GYPCHEK . This was a cooperative project with APHIS-PPQ, TDA and FPM. No male moths have been caught in either area to date. A new infestation has been confirmed in Grainger County with over 4,300 moths caught to date. Two other sites had multiple moth catches in the state. Eradication projects are anticipated next year. The Arkansas State Plant Board and APHIS-PPQ cooperated to treat approximately 600 acres of private land with two application of dimilin to eradicate an infestation of gypsy moth in Newton County, Ar. This infestation is believed to date back to 1984 or 1985. Post-treatment evaluations indicate the treatment was successful in eliminating populations in the treatment area. Trapping this year shows the infestation to be wide spread with potentially 25,000 acres affected. Eradication efforts will continue in this area next year. Table 1 is a summary of acreage treated in Region-8.

Table 1: Summary of acreage treated for eradication and suppression of the gypsy moth in Region-8 by ownership and pesticide.

OWNERSHIP	PESTICIDE	ACRES
North Carolina S&PF Coop	*Bacillus thuringiensis*	360
Virginia S&PF Coop	*Bacillus thuringiensis*	21419
" " "	Dimilin	40035
Tennessee Eradication	Dimilin	2 x 840=1680
" "	Gypchek	2 x 155=310
Georgia Eradication	*Bacillus thuringiensis*	2 x 1937=3874
Arkansas Eradication	*Bacillus thuringiensis*	2 x 600=1200
George Washington NF	*Bacillus thuringiensis*	6130
" " "	Dimilin	688
" " "	Gypchek	25
Blue Ridge Parkway USDI	Dimilin	828
" " "	*Bacillus thuringiensis*	537
Manassas NBF Park USDI	*Bacillus thuringiensis*	400
Prince William Forest USDI	*Bacillus thuringiensis*	296
" " " "	Gypchek	2 x 313=616
Shenandoah NP USDI	Dimilin	1176
Quantico Marine Base DOD	Dimilin	3440
" " " "	*Bacillus thuringiensis*	926

Exotic Gypsy Moths, Wilmington, NC

An infestation of gypsy moths (DNA analysis indicated the Asian, European and hybrid forms) were accidentally introduced at the Sunny Point military ocean terminal south of Wilmington , North Carolina in early July. The moths were found on and in the hold of a container ship leased to the Military Sealift Command. Initial pheromone trap catches indicate from 50,000 to 100,000 acres could be potentially affected. An eradication project is planned for this area next year.

Slow the Spread Pilot Project

In 1993 the Forest Service implemented a "Slow the Spread" (STS) pilot project. The goal of the project is to determine the feasibility of using Integrated Pest Management strategies to slow the spread of the gypsy moth over a large geographical area.

Objectives

The objectives of the project are:

1. Demonstrate that new and current technology can slow the rate of spread of the gypsy moth populations.

2. Assess the technological, economic, ecological, and environmental ability of implementing an operational STS program.

3. Implement a plan for integration of STS technology into a national strategy for suppression of the gypsy moth, assuming the STS project is successful.

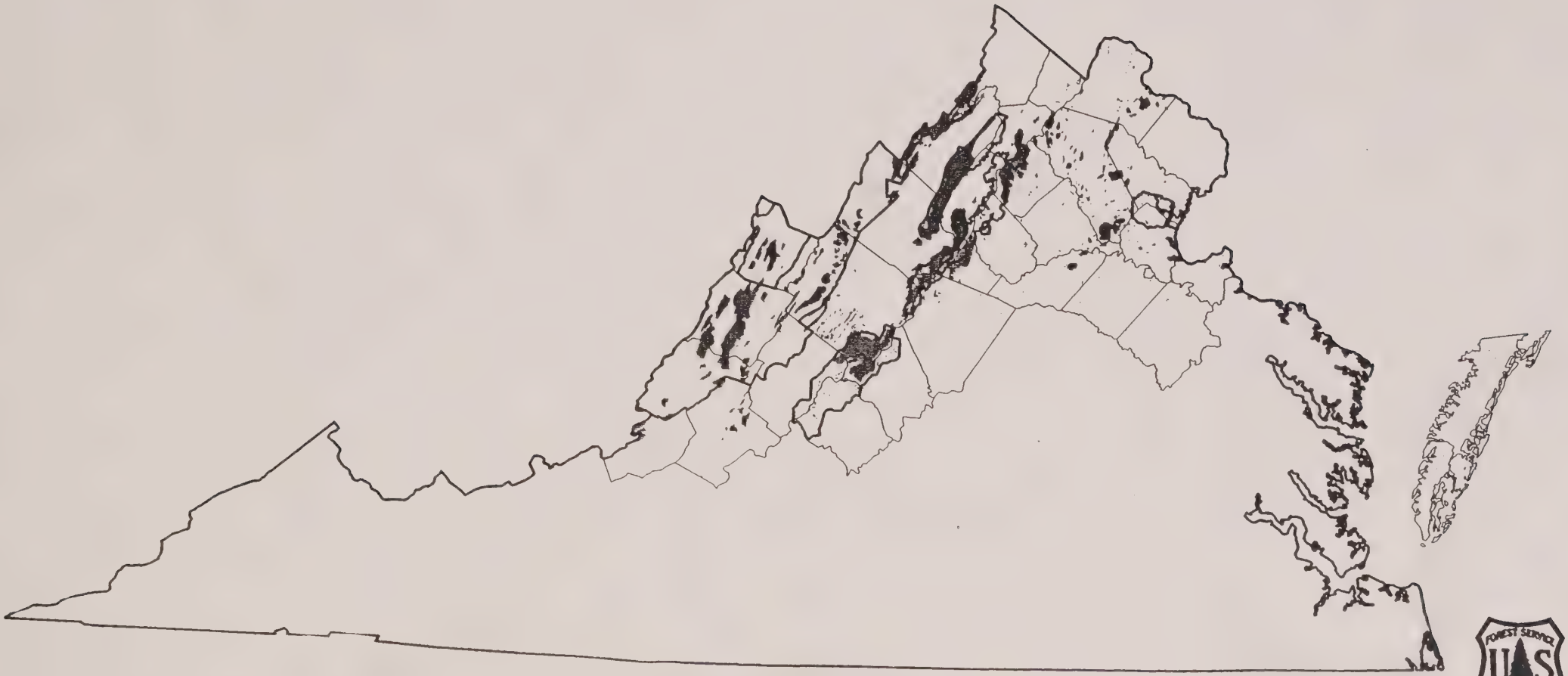
The project area includes areas of Virginia, West Virginia, North Carolina and the upper peninsula of Michigan for a total project area of 3,409,013 hectares. Table 2 is a summary of intervention activities conducted in 1993.

Table 2: Summary of Slow the Spread intervention activities in 1993.

OWNERSHIP	PESTICIDE	ACRES
Jefferson NF	Pheromone flakes	2248
Virginia S&PF Lands	Pheromone flakes	338
West Virginia S&PF	Pheromone flakes	237
North Carolina S&PF	*Bacillus thuringiensis*	2 x 3400=6400

Preliminary results from ground surveys, aerial surveys and aerial photo reconnaissance show 801,878 acres were defoliated in R-8 by the gyspy moth in 1993. This estimate of defoliation is now being verified and may be lower when the final analysis is completed. Defoliation by the gyspy moth in R-8 is shown in Figure 1.

1993 Defoliation in Virginia



Steve Munson

John Anhold

A Report to the National Steering Committee
For Management of Gypsy Moth and
Eastern Defoliators

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The fifth year of the Utah Gypsy Moth Eradication Project was conducted in 1993 with 5,135 acres sprayed. The success of the 1993 treatment will be determined upon completion ot trapping the end of October. Approximately 10,000 traps were deployed this summer which includes detection, delimitation, mass and move-in trapping. Several special projects have been conducted with this years program.

1993 UTAH GYPSY MOTH ERADICATION PROGRAM

TREATMENT - Aerially treated acreage dropped approximately 65 percent from acreage treated in 1992 (15,718 acres). Aerial application of Bacillus thuringensis, (Bt) was applied over 9 blocks consisting of 5,135 acres within 3 counties in 1993 (Table 1). Each spray block was treated three times at five day intervals. A Bell 206 B-III was used for application. The aircraft was equipped with four electronic rotary atomizer Beecomist nozzels calibrated to deliver 64 oz. per acre. Dipel 6AF at 24 BIU's was applied neet for all three applications. Application costs, which include the cost of the Bt and aerial application was $7.69 per acre. There was also approximately 15 acres treated from the ground. A truck mounted mist blower was used to apply 64 oz. of Bt at a dilution rate of 50:1 with water. The foliage coverage was very good in all three applications.

Treatment success will be determined once all traps have been retrieved the end of October. Also at that time, the 1994 aerial treatment areas will be discussed if necessary.

Surveys for sensitive species of non-target moths and butterflies continue to be conducted so that mitigating measures can be taken if conflicts arise with potential future treatment areas. This information is being placed on a GIS as a data layer to help determine areas of conflict with aerial and ground treatment.

TRAPPING - This years trapping program consists of four trapping arrays; detection, delimitation, mass, and move-in trapping. Total traps deployed for 1993 was approximately 10,000, a decrease of 2,000 traps from last year (Table 2). Retrieval of traps will begin in September and continue through October.

SPECIAL PROJECTS

Drift/dispersion and effect of Bacillus thuringiensis (Bt) in mountain terrain on non-target Lepedoptera:

Objectives:

1) to evaluate the effects of Bt on selected non-target Lepidoptera species in the Wasatch Mountain Range of northern Utah.

2) to quantify the deposition of Bt on host foliage of non-target Lepidoptera and to compare results with FSCBG model predictions of deposition on host foliage.

3) to evaluate size of buffer zones needed to protect non-target Lepidoptera colonies from Bt spray drift.

4) to compare FSCBG model drift predictions to dosage recoveries from Rotorod spinning samplers; and deposition recoveries from Mylar deposit samplers and Gambel oak foliage.

5) to evaluate the ValMet module of FSCBG dispersion predictions by comparing predictions to Bt deposition and airborne dosage.

6) to evaluate relationship of Bt recoveries among sampler types and Gambel oak foliage.

7) to investigate residual Bt aerosols that might persist at mouth of Mill Creek Canyon after treatment.

Release and Capture of Sterile Gypsy Moth in Mountainous Terrain:

Objectives: 1) to determine percent recapture and flying distances of released sterile male moths using various trapping grids within different terrains.

2) to determine tho optimum trapping grid system for mountainous terrain.

Effects of Temperature and Relative Humidity on GM Pupae.

Objectives: 1) to determine effects of temperature and relative humidity on GM pupae survivability as related to location within the stand canopy and aspect.

Table 1. 1993 Spray Block Acreage

Spray Block	Federal	Non-Federal	Wilderness	Total
SL-1 Parleys	270	335		605
SL-2 Millcreek	622	234	255	856
SL-3 Big Cottonwood	800	5	641	805
SL-4 Bells Canyon	62	274	19	337
UT-1 Provo City	317	310		627
UT-2 Pole Canyon	584	206		790
UT-3 Timp Slide	22	288		309
WA-1 Bear Canyon	43	586		629
WA-2 North Fork	0	177		177
TOTAL ACRES	2,720	2,415	915	5,135

Table 2. Trap Arrays and Number Placed in Utah from 1988-1993.

Trap Array	1988	1989	1990	1991	1992	1993*
Urban Delimiting	1550	3100	3100	2330	2000	1800
Mountain Delimiting	237	1228	1990	2492	2492	2200
Detection	-	570	169	800	700	500
Mass	-	500	2210	2014	3600	3000
Move-In	-	-	-	180	1000	2500
TOTALS	1737	5398	7469	7818	11800	10000

*1993 trapping numbers are an estimate, actual numbers will be determined the end of October.

Steve Munson

US/Russia Project

United States / Russia

Project Operation Plan

MONITORING ASIAN GYPSY MOTH POPULATIONS IN THE PORT AREAS OF VLADIVOSTOK, NAKHODKA, AND VOSTOCHNYY IN 1993

Cooperators

United States Forest Service, Forest Pest Management

United States Animal and Plant Health Inspection Service

Federal Forest Service of Russia

Plant Quarantine Inspection Service of Russia

INTRODUCTION

Due to increased trade with Russia, the likelihood of exotic pest introductions into North America has also increased. The Asian Gypsy Moth (AGM), Lymantria dispar, a voracious pest of trees, has already been discovered in pheromone baited traps in the Pacific Northwest. This introduction posed a major threat to forests and agriculture on the North American continent and required a multimillion dollar effort to eradicate the infestation in 1992.

The Asian strain of gypsy moth is native to eastern Asia. It was first identified in North America late in 1991 near the port of Vancouver in British Columbia. Since then more than 25 gypsy moths, collected from traps in Washington, Oregon, and British Columbia, have been identified as the Asian strain. Ships infested with egg masses from ports in eastern Russia probably introduced the pest while visiting West Coast ports when larvae hatched from eggs and were blown ashore.

If established in the United States and Canada, each AGM female could lay egg masses that in turn could yield hundreds of voracious caterpillars with host preference for more than 500 species of trees and shrubs. Damage caused by the AGM may cause tree and/or shrub mortality or increased susceptibility to diseases and other insects. Silk strands, insect excretment, defoliated trees and dead caterpillars or moths would pose a nuisance in homes, yards and parks. The hairs from the immature stages of AGM can cause allergic reactions in some individuals.

Potential AGM hosts are abundant in western North America from Alaska to Mexico. Studies indicate that AGM will likely be a voracious feeder on susceptible hosts. Coniferous trees, which are not normally attacked by low populations of this insect are likely to be significantly affected when AGM populations reach outbreak levels. Apple and other fruit trees are favored hosts, and in agricultural areas of Russia there are reports that AGM has fed on adjacent wheat fields when the foliage of preferred hosts has been consumed.

An ecomonic analysis of the potential impact of AGM conducted by the USFS indicates potential losses of $3.5 billion from this pest, if it should become established in the United States. This analysis does not include potential losses posed by other Lymantriid species (L. monacha and L. mathura) which are native to the same areas as AGM and have a similar potential for introduction into North America.

METHODS

FOREST AREA MONTIORING

Responsibility: The Federal Forest Service of Russia has the task of implementing the monitoring procedures for AGM in the surrounding forest areas of Vladivostok, Nakhodka, and Vostochnyy.

Adult Monitoring -

Two monitoring Zones will be established around each of the three port areas listed above.

Zone 1 -- adult populations will be monitored using gypsy moth pheromone baited traps (milk carton type) in a five kilometers radius around each of the three ports. In forested sites, traps will be placed along designated trapping routes (trap lines) five kilometers in length at 800 meter intervals. Distance between trap lines is two kilometers. The installation of trapping lines will be confined to forest paths, cuttings, roads, existing fire lines and fire prevention strips. If 50 or more moths are caught in a trap, distance between trap lines will be decreased to one kilometer the following year.

Zone 2 -- adult populations will be monitored using gypsy moth pheromone baited traps (milk carton type) in a 15 kilometer radius surrounding Zone 1. Procedures to place traps are similar to those described for Zone 1, except distance between trap lines is six kilometers rather than the two kilometer spacing used to place traps in Zone 1. Along the trap lines, pheromone traps will be placed at 800 meter intervals. In Zone 2, if 50 or more moths are caught within a trap during the 1993 flight period, trap line distance will be decreased to one kilometer the following year.

Within Zones one and two, all accessible traps will be checked twice each week to record number of AGM adults trapped between each visit. Inaccessible traps will be checked once every two weeks to record the same information. The number of other Lymantriid species caught within the pheromone traps will also be identified and counted each time pheromone traps are checked. Traps DO NOT need to be replaced unless damaged or missing.

One light trap site will be established in each of the three forested areas surrounding each port. A light trap will be installed and monitored beginning one week before expected adult flight for any of the following three species: L. dispar, L. monacha and L. mathura. Each light trap will be serviced daily during the adult flight period to record species, number and sex of adult moths caught.

Larva, Pupae and Egg Mass Monitoring -

Three to six permanent plots will be established within the forested area surrounding each port. Permanent plots should be placed in areas of susceptible host type. Previous surveys by Russian forest pest specialists have identified foci, within certain host types, where increasing populations of the AGM are first detected.

Permanent plots will be one hectare in size in which 30 host trees greater than 12.7 centimeters in diameter will be burlap banded. Burlap banded trees will be inspected twice each week to record larval and pupal stages of the three Lymantriid species mentioned previously. Some life stages of each species found will be collected and reared in the laboratory to document the presence/absence of parasites and pathogens.

Trap catches of 100 or more moths in individual traps indicates increasing populations of AGM. Previous studies conducted by Russian scientists, Chelysheva and Orlov (1986) have found that if catches exceed 100 moths, egg mass surveys should be conducted. In areas where catches are less than 100 moths per trap, egg masses are difficult to find.

If a trap exceeds 100 moths, egg mass surveys will be conducted using fixed and variable radius plots. A fixed-radius plot of 2.52 meters (0.002 ha) will be established at each trap site with 100 or more moths. A complete inspection of

all substrate (rocks, woody debris, etc.) and understory is conducted. A variable-radius plot (20 BAF) will be established using the same plot center to select overstory trees. Trees that are within the 20 BAF plot area will be inspected for egg masses. A complete inspection of the tree's bole and leaf surface will be used to determine egg mass numbers.

Egg mass surveys will also be conducted along the trap lines until the trap counts are less than 100 moths per trap. At the last trap along the trap line with less than 100 moths, egg mass surveys will continue until 400 overstory trees have been inspected. A subsample of egg masses will be collected to determine eggs/mass (this technique has been used by the Russian forest pest specialists to measure population trends).

Data Analysis -

The location of all pheromone traps and permanent plots will be recorded on 1:25,000 scale forest vegetation maps. Data sheets will be provided to the Plant Quarantine Service of Russia on a weekly basis within each port for summary and transfer of the data to the United States Animal and Plant Health Inspection Service. Analysis of the data collected and a final report will be prepared jointly by the United States Animal and Plant Health Inspection Service and the United States Forest Service.

PORT AREA MONITORING

Responsibility - Plant Quarantine Inspection Service of Russia will be responsible for monitoring activities conducted in the three port areas identified previously and an additional three ports; Vanino, Ol'ga and Petropavlovsk.

Level 1 - Port Monitoring in Vladivostok, Nakhodka, and Vostochnyy (Level 1 ports have ship traffic that originates within the port with destination points in North America).

Adult Monitoring -

Five ultraviolet light traps will be placed at each of the three Russian ports. Traps will be placed to maximize coverage of each port, preferably in areas where other artificial lights will not interfere with the light source used for each trap. Ideally, traps would be placed between the first line of port structures and the adjoining forest. Traps should be elevated, a pulley system will be used to facilitate checking. Light traps should be placed in areas where previous egg laying activity has occurred. The light traps will be installed and monitored one week before expected adult flight of any of the following three species: L. dispar, L. monacha and L. mathura. Each light trap will be serviced daily during the adult flight to record species, number and sex of adult moths caught.

A minimum of 20 milk carton pheromone traps will be deployed within each of the three port areas. Traps should be strategically placed to maximize coverage of the port area. Each pheromone trap will be checked daily to record number and species of adult catches.

Egg Mass Monitoring -

A minimum of ten, one meter square areas at each port will be cleaned to remove accumulation of old egg masses. These one meter square areas can be located on the sides of buildings, on light towers or any other surface where a large amount of oviposition had occurred previously. If flat surfaces are unavailable, then meter sections of light poles can be substituted. Ovipositional panels that can be raised or lowered can also be used to record egg mass deposition. Egg mass deposition sites will be checked daily to record number and species of egg masses deposited. After recording this information, egg masses will be removed from the sampling surface.

Level 2 - Port Monitoring in Ol'ga, Vanino and Petropavlovsk (Level 2 ports are located in areas where suspected activity of the Lymantriid complex may occur. Ships originating in these ports primarily travel along the coast of Siberia and Asia. However, some ships may make intercontinental voyages and a small monitoring program will be initiated to document the presence/absence of the Lymantriid complex.)

Adult Monitoring -

Only pheromone milk carton traps will be installed in the Level 2 port areas. Twenty milk carton pheromone traps will be stratigically placed within the ports to maximize coverage. All traps will be checked daily to record number and species of adult moths captured.

Data Analysis -

The location of all pheromone traps and egg mass monitoring sites will be recorded on large scale (1:25,000) city maps. All information collected within Level 1 ports will be sent to the Plant Quarantine Inspection Service of Russia in Vladivostok on a weekly basis. Level 2 ports will report trap results once every two weeks to Vladivostok.

Data will be summarized by Plant Quarantine staff and submitted to the United States Animal and Plant Health Inspection Service. At the conclusion of the 1993 AGM monitoring program, data will be analyized and a final report submitted to all cooperators by the United States Animal and Plant Health Inspection Service and the United States Forest Service.

Final Report -

A risk assessment will be conducted for each port using the life stage information collected in both port and forested areas. This information will be used to modify (improve) the monitoring efforts for the Lymantriid complex. The data will also be used to determine treatment thresholds for suppression efforts, and to make modifications or adjustments in the United States Animal and Plant Health Inspection Service's vessel exclusion policy. Although no suppression efforts may be required in 1994, the information gathered will be used to develop a data base for determining if and when suppression tactics are necessary.

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Moth Captures in Light Traps

For Period Starting: _____ **and Ending On:** _____
(month/day/year) (month/day/year)

Agency	Port	Trap #	Check Dates	Number of moths for all checks this period			
				L. dispar	*L. monacha*	*L. mathura*	*Other*
Quarantine	Vladivostock						
		Subtotal: Number of moths by port					
Quarantine	Nakhodka						
		Subtotal: Number of moths by port					
Quarantine	Vostochnyy						
		Subtotal: Number of moths by port					
Forestry							
		Subtotal: Number of moths by port					
Forestry							
		Subtotal: Number of moths by port					

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Trap Record: Male Moth Captures in Pheromone Traps

Agency (circle one): Russian Federal Forest Service   Plant Quarantine

Port (circle one): Vladivostok   Vostochnyy   Vanino
Nakhodka   Ol'ga   Petropavlosk

Trap Number: ____________   **'Date trap installed:** ____________
(month/day/year)

Date Checked		Trap Condition Code		# of moths since last check		
				L. dispar		*L. monacha*

Trap Condition Codes
1. Undamaged
2. Trap missing since last check - trap replaced
3. Trap missing since last check - trap not replaced

Season Totals	
L. dispar	*L. monacha*

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Light Trap Record

Agency (circle one): Russian Federal Forest Service Plant Quarantine

Port (circle one): Vladivostok Vostochnyy Nakhodka

Trap Number: ______________ **Date Trap Installed:** ______________
(month/day/year)

Date Checked	Number of moths since last check				Date Checked	Number of moths since last check			
	L. dispar	*L. monacha*	*L. mathura*	Other		*L.dispar*	*L.monacha*	*L.mathura*	Other

Total moths all season			
L. dispar	*L. monacha*	*L. mathura*	Other

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Egg Masses on Square Meter Surfaces

For Period Starting: _____ and Ending On: _____
(month/day/year) (month/day/year)

Port	Sampling Surface #	Check Dates	Number of moths for all checks this period			
			L. dispar	*L. monacha*	*L. mathura*	*Other*
Vladivostok	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
		Subtotal for Port				
Nakhodka	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
		Subtotal for Port				
Vostochnyy	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
		Subtotal for Port				

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Male Moth Captures in Pheromone Traps

For Period Starting: ______________________ **and Ending On:** ______________________
(month/day/year) (month/day/year)

Agency (circle one): Russian Federal Forest Service Plant Quarantine

Port (circle one): Vladivostok Vostochnyy Vanino
Nakhodka Ol'ga Petropavlosk

Trap #	Dates Checked	# moths for all checks this period		Trap #	Dates Checked	# moths for all checks this period	
		L. dispar	*L. monacha*			*L. dispar*	*L. monacha*

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Life Stages Under Burlap Bands

Port	Plot #	Total Number of trees banded	Date Checked	Date Last Checked	Number of life stages under all burlap bands on the plot							
					L. dispar		*L. monacha*		*L. mathura*		Other	
					larvae	pupae	larvae	pupae	larvae	pupae	larvae	pupae
Vladivostok	1											
	2											
	3											
	4											
	5											
	6											
			Subtotal for port									
Nakhodka	1											
	2											
	3											
	4											
	5											
	6											
			Subtotal for port									
Vostochnyy	1											
	2											
	3											
	4											
	5											
	6											
			Subtotal for port									

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Egg Mass Survey Record for Ports
(egg masses counted on square meter surfaces)

Port (circle one): Vladivostok Vostochnyy Nakhodka

Sample Surface #: ______ **Size:** ______ (square meters) **Date Surface Installed:** ______ (month/day/year)

Date	Number of egg masses since last check			
Checked	*L. dispar*	*L. monacha*	*L. mathura*	Other

Date	Number of egg masses since last check			
Checked	*L.dispar*	*L.monacha*	*L.mathura*	Other

Total egg masses all season			
L. dispar	*L. monacha*	*L. mathura*	Other

Agreement No. 12-34-81-0231-CA

COOPERATIVE PROJECT AGREEMENT
Between
UNITED STATES DEPARTMENT of AGRICULTURE
FOREST SERVICE
ANIMAL and PLANT HEALTH INSPECTION SERVICE
And
PLANT QUARANTINE INSPECTION SERVICE of RUSSIA

PREAMBLE

Due to increased trade with Russia, the likelihood of exotic pest introductions into North America has also increased. The Asian Gypsy Moth (AGM) (Lymantria disbar), a voracious pest of trees, has already been discovered in pheromone-baited traps in the Pacific Northwest. This introduction posed a major threat to forests and agriculture on the North American continent and required a multimillion dollar effort to eradicate the infestation.

The Asian strain of gypsy moth is native to eastern Asia. It was first identified in North America late in 1991 near the Port of Vancouver in British Columbia. Since then more than 25 gypsy moths, taken from traps in Washington, Oregon, and British Columbia, have been identified as the Asian strain. Ships infested with egg masses from ports in eastern Russia probably introduced the pest while visiting West Coast ports when larvae hatched from eggs and were blown ashore.

If established in the United States and Canada, each AGM female could lay egg masses that in turn could yield hundreds of voracious caterpillars with appetites for more than 500 species of trees and shrubs. AGM defoliation would severally weaken trees and shrubs, killing them or making them susceptible to diseases and other pests. Caterpillar silk strands, droppings, destroyed leaves, and dead moths would be a nuisance in homes, yards, and parks. Hairs from caterpillars cause allergic reactions in some people. Potential AGM hosts are abundant in western North America from Alaska to Mexico. Studies show that AGM will likely be a voracious feeder on these hosts. In addition, coniferous trees which would not normally be attacked are likely to be significantly impacted when AGM populations build up to high levels. Apple and other fruit trees are favored hosts, and there are reports from Russia that AGM has fed on adjacent wheat fields when it has consumed the foliage of preferred hosts.

An economic analysis of the potential impact of AGM conducted by the USFS indicates potential losses of $3.5 billion from this pest, if it should become established in the United States. This analysis does not include potential losses posed by other Lymantriid species (L. monacha and L. mathura) that are native to the same areas as AGM and have a similar potential for introduction into North America.

ARTICLE 1 - PURPOSE

In order to assess and reduce the risk of future introductions of AGM (and other Lymantriid species) into North America, the United States Department of Agriculture (USDA), Forest Service (USFS) and Animal and Plant Health Inspection Service (APHIS) in cooperation with the Plant Quarantine Inspection Service of Russia (PQIS) agreed to develop a system to monitor AGM populations in and around Far Eastern Russian Ports engaged in international trade with North America.

The Objectives covered by this Agreement include:

1. Gathering information needed to determine when control measures are needed to reduce the likelihood of AGM infestation of ships and containers in the affected ports.

2. Determining which months ships are at risk of infestation.

3. Developing and improving current survey techniques for AGM and other Lymantriid species.

4. Opening lines of communication and information transfer regarding pest risk assessment and control.

All field work contemplated under this Agreement will be accomplished in Calendar Year 1993.

It is anticipated that if work under this Agreement is successfully completed in 1993, an Agreement may be developed to continue cooperation in 1994, subject to the provisions of Article 6, paragraph 6 of this Agreement.

ARTICLE 2 - AUTHORITIES

This Cooperative Project Agreement is entered into by the United States Forest Service (USFS), the Animal Plant Health Inspection Service (APHIS) and the Plant Quarantine Inspection Service of Russia (PQIS) pursuant to authority existing in the Organic Act of 1944, as amended, (Title 7 United States Code (USC) 147a), the Cooperative Forestry Assistance Act of 1978, as amended, (16 USC 2101 et seq.), and the International Cooperative Forestry Act of 1990 (PL 101-512).

ARTICLE 3 - USFS RESPONSIBILITIES

USFS agrees to:

1. Provide technical assistance at project initiation and review of ongoing operations.

2. Provide, as part of its contribution, the use of equipment, as agreed upon in the Project Operation Plan. One vehicle will be loaned to the PQIS for the AGM monitoring in the Primorsk Region. Dr. Andrew D. Orlinski of the Russian Plant Quarantine Service, will be responsible for this vehicle. Two additional vehicles will be loaned, under a separate Agreement, to the Federal Forestry Service of Russia for use in and between the three primary ports involved in the program. The USFS will maintain ownership of the vehicles but will waive all liability and maintenance responsibilities associated with the use of these vehicles. The vehicles will remain in Russia as long as there is an Agreement for an approved project.

3. Provide funding to cover the direct costs associated with the Project including labor, related travel, and other operational activities as agreed upon in the Project Operation and Financial Plans.

4. Analyze collected data and provide results to the Authorized Representative of the PQIS.

ARTICLE 4 - APHIS RESPONSIBILITIES

APHIS agrees to:

1. Designate Mr. Terry McGovern as the Authorized Representative of the USDA to serve as the principal USDA contact for all activity related to this project.

2. Provide technical assistance at the project initiation and review of ongoing operations.

3. Provide, as part of its contribution, the use of USDA owned disposable trapping supplies, as agreed upon in the Project Operation Plan. This includes shipment of the such supplies to a Northwest U.S. port to facilitate their eventual shipment to Vladivostok, Russia.

4. Analyze collected data and provide results to the Authorized Representative of PQIS.

ARTICLE 5 - PQIS RESPONSIBILITIES

PQIS agrees to:

1. Designate Dr. Andrew D. Orlinski, as the Authorized Representative of the PQIS to coordinate with the Authorized Representatives of Federal Forestry Service of Russia and the USDA.

2. Provide overall project management and field supervision in cooperation with USFS and APHIS in accordance with the Project Operation Plan.

3. Provide, as part of it's contribution, "in-kind services", such as administrative support and technical expertise necessary to jointly complete this project.

4. Submit to the Authorized Representative of the USDA "Request for Advance or Reimbursement" forms (SF-270) to request funds for payment for expenditures.

5. Make an accounting of the funds obtained from the USDA and submit a "Financial Status Report" form (SF-269) quarterly and a final report within 90 days of termination or expiration of the Agreement. Any unobligated balance upon termination or expiration of this Agreement shall be returned to the USDA.

6. Provide to the Authorized Representative of the USDA a quarterly work accomplishment report which will be used to verify compliance with the terms of the Agreement.

7. Provide secure storage, accountability, and maintenance for all USDA vehicles and all other USDA provided equipment and supplies used on the Project.

8. Indemnify the United States for any and all property damage and personal injury resulting from activities conducted under this Agreement, including the use of USDA owned vehicles or any other equipment or supplies and further agrees to save and hold harmless the United States from any and all claims for such property damage and personal injury. PQIS further agrees to reimburse the United States by and through the USDA for property damage to vehicles or other property for which USFS or APHIS is responsible, less normal wear and tear which may occur through use of said property, including vehicles, under this Agreement.

9. Provide suitable office space for all Project Staff, equipped with telephone and electricity at each port as needed.

10. Provide for interpretation and transportation needs of USDA Officials during visits to port areas.

11. Provide electric sources for light traps as needed.

12. Beginning with the male moth flight, send by fax, on a weekly basis, summary data for all data collected, using the designated format.

13. Accept administrative responsibility for all field personnel to include hiring, payroll, etc.

14. Provide for transport of equipment and supplies from a Northwest U.S. port to Vladivostok.

ARTICLE 6 - MUTUAL RESPONSIBILITIES AND AGREEMENT

USFS, APHIS, and PQIS mutually agree that:

1. Project Operation and Financial Plans that will fully describe responsibilities of all parties will be developed and implemented. These plans are to be developed within 20 Calendar days after the execution of this Agreement and become part of this Agreement.

2. All funds, "in-kind" services, and other contribution expended or provided by any party on behalf of this project prior to the date of final signature of this Agreement shall count towards the party's total contribution. All "in-kind services" must be fully supportable.

3. For purposes of cooperation under this Agreement, each party shall designate a key official to serve as a contact. Each person identified will have written designated authority.

4. Pursuant to 41 USC 22 no member or delegate to the United States Congress shall be admitted to any share or part of this Agreement or to any benefit to arise therefrom.

5. Amendments or modifications to the Project Operation and Financial Plans, covered within the scope of this Agreement may be made upon written concurrence of all parties.

6. USFS and APHIS funding or other support, including technical assistance, for the project covered by this Agreement is contingent upon the passage by the United States Congress of an appropriation from which expenditures may be legally met and shall not obligate USFS and APHIS upon failure of Congress to so appropriate. Funding and other assistance provided under this Agreement may also be reduced or terminated if Congress only provides to USFS or APHIS for a finite period under a Continuing Resolution.

7. The USDA reserves the right to require PQIS to transfer any equipment (including title), supplies, or other property purchased under this Agreement with Federal funds back to the USDA or to another party as indicated by the USDA. USDA shall pay, or reimburse PQIS, for reasonable costs associated with any transfer.

8. This Agreement covers part of an overall project that involves the PQIS and the Federal Forestry Service of Russia, the USFS, and APHIS. A similar Agreement is being executed between USFS, APHIS, and the Federal Forestry Service of Russia. All parties to the overall project are expected and required to provide full cooperation in the execution of Project Operation and Financial Plans, including use of vehicles, other equipment, and other supplies furnished by USFS and APHIS.

ARTICLE 7 - AGREEMENT TERMS

This Agreement shall become effective upon the date of final signature and shall continue until March 31, 1994. It may be amended at any time by mutual agreement of the parties to each other in writing. This Agreement may be terminated by either party upon 30 days written notice, when commitments set forth in this Agreement and in the Project Operation Plan and Financial Plan are not met or for any other good cause, including the provisions covered by Article 6, paragraph 6 of this Agreement. This Agreement is done in both the English and Russian languages, each text being equally authentic.

U.S. Forest Service — Date 5/19/93

Michael C. Gregoire — 6/4/93

U.S. Animal Plant Health Inspection Service — Date

Plant Quarantine Inspection Service of Russia — Date

Standard Form 270

REQUEST FOR ADVANCE OR REIMBURSEMENT

Approved by Office of Management and Budget, No. 80-R0183 — PAGE OF PAGES

1. (See instructions on back) FEDERAL SPONSORING AGENCY AND ORGANIZATIONAL ELEMENT TO WHICH THIS REPORT IS SUBMITTED: USDA; APHIS and USFS

2. TYPE OF PAYMENT REQUESTED: a. Is this a request for: ☒ ADVANCE ☐ REIMBURSEMENT; b. Is this the: ☐ FINAL ☒ PARTIAL

3. BASIS OF REQUEST: ☒ CASH ☐ ACCRUAL

4. EMPLOYER IDENTIFICATION NUMBER:

5. RECIPIENT'S ACCOUNT NUMBER OR IDENTIFYING NUMBER: 180 00 885 Y/O

6. FEDERAL GRANT OR OTHER IDENTIFYING NUMBER ASSIGNED BY FEDERAL AGENCY: 93-CA-121

7. PARTIAL PAYMENT REQUEST NUMBER FOR THIS REQUEST:

8. PERIOD COVERED BY THIS REQUEST: FROM (Month, day, year) 04.01.1993 TO (Month, day, year) 06.30.1993

9. RECIPIENT ORGANIZATION: Name: SOYUZVNESHTORGREKLAMA Foreign Trade Bank; Name and Street: EPS MOBB (EAST PALEARCTIC SECT. OF THE INT. ORG. F. BIOLOGIC. CONTR. OF NOXIOUS ORGANISMS) MOSCOW SERPUKHOVSKOY VAL; 8, RUSSIA

10. PAYEE (Where check is to be sent if different than item 9): Name: USDA Forest Service; Number and Street: ; City, State and ZIP Code:

11. COMPUTATION OF AMOUNT OF REIMBURSEMENTS/ADVANCES REQUESTED

PROGRAMS/FUNCTIONS/ACTIVITIES →	(a)	(b)	(c)	TOTAL
a. Total program outlays to date (As of date) 05.18.1993	6,000	$	$	$
b. Less: Cumulative program income	-			
c. Net program outlays (Line a minus Line b)	6,000			
d. Estimated net cash outlays for advance period	12,750			
e. Total (Sum of lines c & d)	18,750			
f. Non-Federal share of amount on line e	4,250			
g. Federal share of amount on line e	14,500			
h. Federal payments previously requested	-			
i. Federal share now requested (Line g minus line h)	14,500			
j. Advances required by month, when requested by Federal grantor agency for use in making pre-scheduled advances — 1st month	2,000			
2nd month	7,500			
3rd month	5,000			

12. ALTERNATE COMPUTATION FOR ADVANCES ONLY

a. Estimated Federal cash outlays that will be made during period covered by the advance	$ 14,500
b. Less: Estimated balance of Federal cash on hand as of beginning of advance period	-
c. Amount requested (Line a minus Line b)	$ 14,500

13. CERTIFICATION

I certify that to the best of my knowledge and belief the data above are correct and that all outlays were made in accordance with the grant conditions or other agreement and that payment is due and has not been previously requested.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL: [signature] — DATE REQUEST SUBMITTED: 05.18.1993

TYPED OR PRINTED NAME AND TITLE: Savoticor I.F. Head of Russian Plant Quarantine Inspection Service

TELEPHONE (Area Code, Number, Extension): 095 | 250-57-69

Take space for agency use

I RECOMMEND THAT PAYMENT BE MADE AS DIRECTED.
TERRY McGOVENN, USDA, APHIS
Terry McGovenn
6/14/93

UNITED STATES COOPERATIVE AGREEMENT
Between
UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)
UNITED STATES FOREST SERVICE (USFS)
UNITED STATES ANIMAL and PLANT HEALTH INSPECTION SERVICE (USAPHIS)
And
FEDERAL FORESTRY SERVICE OF RUSSIA

PREAMBLE

Due to increased trade with Russia, the likelihood of exotic pest introductions into North America has also increased. The Asian Gypsy Moth (AGM) (Lymantria), a voracious pest of trees, has already been discovered in pheromone-baited traps in the Pacific Northwest. This introduction posed a major threat to forests and agriculture on the North American continent and required a multimillion dollar effort to eradicate the infestation.

The Asian strain of gypsy moth is native to eastern asia. It was first identified in North America late in 1991 near the Port of Vancouver in British Columbia. Since then more than 25 gypsy moths, taken from traps in Washington, Oregon, and British Columbia, have been identified as the Asian strain. Ships infested with egg masses from ports in eastern Russia probably introduced the pest while visiting West Coast ports when larvae hatched from eggs and were blown ashore.

If established in the United States and Canada, each AGM female could lay egg masses that in turn could yield hundreds of voracious caterpillars with appetites for more than 500 species of trees and shrubs. AGM defoliation would severely weaken trees and shrubs, killing them or making them susceptible to diseases and other pest. Caterpillar silk strands, droppings, destroyed leaves, and dead moths would be a nuisance in homes, yards, and parks. Hairs from caterpillars cause allergic reactions in some people. Potential AGM hosts are abundant in western North America from Alaska to Mexico. Studies show that AGM will likely be a voracious feeder on these hosts. In addition, coniferous trees which would not normally be attacked are likely to be significantly impacted when AGM populations build up to high levels. Apple and other fruit trees are favored hosts, and there are reports from Russia that AGM has fed on adjacent wheat fields when it has consumed the foilage of preferred hosts.

An economic analysis of the potential impact of AGM conducted by the USFS indicates potential losses of $3.5 billion from this pest, if it should become established in the United States. This analysis does not include potential losses posed by other Lymantriid species (L. monacha and L. manthura) that are native to the same areas as AGM and have a similar potential for introduction into North America.

ARTICLE 1 - PURPOSE

In order to assess and reduce the risk of future introductions of AGM (and other Lymantriid species) into North America, the United States Department of Agriculture (USDA), Forest Service (USFS) and Animal and Plant Health Inspection Service (APHIS) in cooperation with the Federal Forest Service of Russia (FFSR) agreed to develop a system to monitor AGM populations in and around Far Eastern Russian Ports engaged in international trade with North America.

The objectives covered by this Agreement include:

1. Gathering information needed to determine when control measures are needed to reduce the likelihood of AGM infestation of ships and containers in the affected ports.

2. Determining which months ships are at risk of infestation.

3. Developing and improving current and survey techniques for AGM and other Lymantriid species.

4. Opening lines of communication and information transfer regarding pest risk assessment and control.

All field work contemplated under this agreement will be accomplished in Calendar Year 1993.

It is anticipated that if work under this agreement is successfully completed in 1993, an Agreement may be developed to continue cooperation in 1994, subject to the provisions of Article 6, paragraph 6 of this Agreement.

ARTICLE 2 - AUTHORITIES

This Cooperative Project Agreement is entered into by the United States Forest Service (USFS), the Animal Plant Health Inspection Service (APHIS) and the Federal Forestry Sercice of Russia (FFSR) pursuant to authority existing in the Organic Act of 1944, a amended, (Title 7 United States Code (USC) 147s), the Cooperative Forestry Assistance Act of 1978, as amended, (16 USC 2101 et seq.) and the International Cooperative Forestry Act of 1990 (pp 101-512), and also by authority of Minutes of the First Meeting of the US - Russian Joint Working Group for Cooperation in the Fields of Forestry of December 16.92.

ARTICLE 3 - USFS RESPONSIBILITIES

USFS agrees to:

1. Provide technical assistance at project initiation and review of ongoing operations

2. Provide, as part of its contribution, the use of equipment, as agreed upon in the Project Operation Plan. Two vehicle will be loaned to the FFSR for the AGM monitoring in the Primorsk Region. Mr. A.T. Popov, Primoria Department of Forest Management Service, will be responsible for these two vehicles. A third vehicle will be loaned, under a separate Agreement, to the Plant Quarantine Inspection Service of Russia for use in and between the three primary ports involved in the program. The USFS will maintain ownership of the vehicles but will waive all liability and maintenance responsibilities associated with the use of these vehicles. The vehicles will remain in Russia as long as there is an Agreement for an approved project.

3. Provide funding to cover the direct costs associated with the Project including labor, related travel, and other operational activities as agreed upon in the Project Operation and Financial Plans.

4. Analyze collected data and provide results to the Authorized Representative of the FFSR.

ARTICLE 4 - APHIS RESPONSIBILITIES

APHIS agrees to:

1. Designate Mr. Terry McGovern as the Authorized Representative of USDA to serve as the principal USDA contact for all activity related to this project.

2. Provide technical assistance at the project initiation and review of ongoing operations.

3. Provide, as part of its contribution, the use of USDA owned disposable trapping supplies, as agreed upon in the Project Operation Plan. This includes shipment of the such supplies to a Northwest U.S. port to facilitate their eventual shipment to Vladivostok, Russia.

4. Analyze collected data and provide results to the Authorized Representative of FFSR.

ARTICLE 5 - FFSR RESPONSIBILITIES

FFSR agrees to:

1. Designate Mr. Alex T. Popov, Chief Forester, Primorsk Forest Region, as the Authorized Representative of the FFSR to coordinate with the Authorized Representative of Plant Quarantine Inspection Service of Russia and the USDA.

2. Provide overall project management and field supervision in cooperation with USFS and APHIS in accordance the the Project Operation Plan.

3. Provide, as part of it's contribution, "in-kind services", such as administrative support and technical expertise necessary to jointly complete this project.

4. Submit to the Authorized Representative of the USDA "Request for Advance or Reimbursement" forms (SF-270) to request funds for payment for expenditures.

5. Make an accounting of the funds obtained from the USDA and submit a "Financial Status Report" form (SF-279) quarterly and a final report within 90 days of termination or expiration of the Agreement. Any unobligated balance upon termination or expiration of this Agreement shall be returned to the USDA.

6. Provide to the Authorized Representative of the USDA a quarterly work accomplishment report which will be used to verify compliance with the terms of the Agreement.

7. Provide secure storage, accountability, and maintenance for all USDA vehicles and all other USDA provided equipment and supplies used on the Project.

8. Indemnify the United States for any and all property damage and personal injury resulting from activities conducted under this Agreement, including the use of USDA owned vehicles or any other equipment or supplies and further agrees to save and hold harmless the United States from any and all claims for such property contributed as agreed upon the project operation plan damage and personal injury. FFSR further agrees to reimburse the United States by and through the USDA for property damage to vehicles or other long-term using property for which USFS or APHIS is responsible, more normal (according to article 6 paragraph 7) wear and tear which may occur through use of said property, including vehicles, under this Agreement.

9. Provide suitable office space within the forested territories for all Project Staff, equipped with telephone and electricity as needed.

10. Provide for interpretation and transportation needs of USDA Officials during visits to port areas.

11. Provide electric sources for light traps as needed.

12. Beginning with the male moth flight, send by fax, on a weekly basis, summary data for all data collected, using the designated format.

13. Accept administrative responsibility for all field personnel to include hiring, payroll, etc.

ARTICLE 6 - MUTUAL RESPONSIBILITIES AND AGREEMENT

USFS, APHIS, AND FFSR mutually agree that:

1. Project Operation and Financial Plans that will fully describe responsibilities of all parties will be developed and implemented. These plans are to be developed within 20 calendar days after the execution of this Agreement and become part of this Agreement.

2. All funds, "in-kind" services, and other contributions expended or provided by any party on behalf of this project prior to the date of final signature of this Agreement shall cound towards the party's total contribution. All "in-kind services" must be fully supportable. All activities fulfilled within the framework of this Agreement will be carried out within the limits of finances allocated for this purpose.

3. For purposes of cooperation under this Agreement, each party shall designate a key official to serve as a contact. Each person identified will have written designated authority.

4. Pursuant to 41 USC 22 no member of delegate to the United States Congress shall be admitted to any share or part of this Agreement or to any benefit to arise therefrom.

5. Amendments or modifications to the Project Operation and Financial Plans, covered within the scope of this Agreement may be made upon written concurrence of all parties.

6. USFS and APHIS funding or other support, including technical assistance, for the project covered by this United States Cooperative Agreement is contingent upon the passage by the United States Congress of an appropriation from which expenditures may be legally met and shall not obligate USFS and APHIS upon failure of the United States Congress to so appropriate. Funding and other assistance provided under this Agreement may also be reduced or terminated if Congress only provides to USFS or APHIS for a finite period under a continuing Resolution.

7. The USDA reserves the right to require FFSR to transfer any equipment (including title), supplies, or other property purchased under this United States Cooperative Agreement with Federal funds back to the USDA or to another party as indicated by the USDA. USDA shall pay, or reimburse FFSR, for reasonable costs associated with any transfer. FFSR is not repsonible for any normal damages of project equipment during the work foreseen by Project Operation Plan. Upon receiving the equipment, representatives of the FFSR and USDA will compile a note on the terms of exploitation of the equipment received.

8. This Agreement covers part of an overall project that involves the FFSR and the Plant Quarantine Inspection Service of Russia, USFS and APHIS. A similar Agreement is being executed between USFS, APHIS, and the Plant Quarantine Inspection Service of Russia. All parties to the overall project are expected and required to provide full cooperation in the execution of Project Operation and Financial Plans, including use of vehicles, other equipment, and other supplies furnished by USFS and APHIS.

ARTICLE 7 - AGREEMENT TERMS

This Agreement shall become effective upon the date of final signature and shall continue until March 31, 1994. It may be amended at any time by mutual agreement of the parties to each other in writing. This Agreement may be terminated by either party upon 30 days written notice, when commitments set forth in this Agreement and in the Project Operation Pland and Financial Plan are not met or for any other good cause, including the provisions covered by Article 6, paragraph 6 of this Agreement. This Agreement is done in both the English and Russian languages, each text being equally authentic.

Michael E. Dann 6/24/93

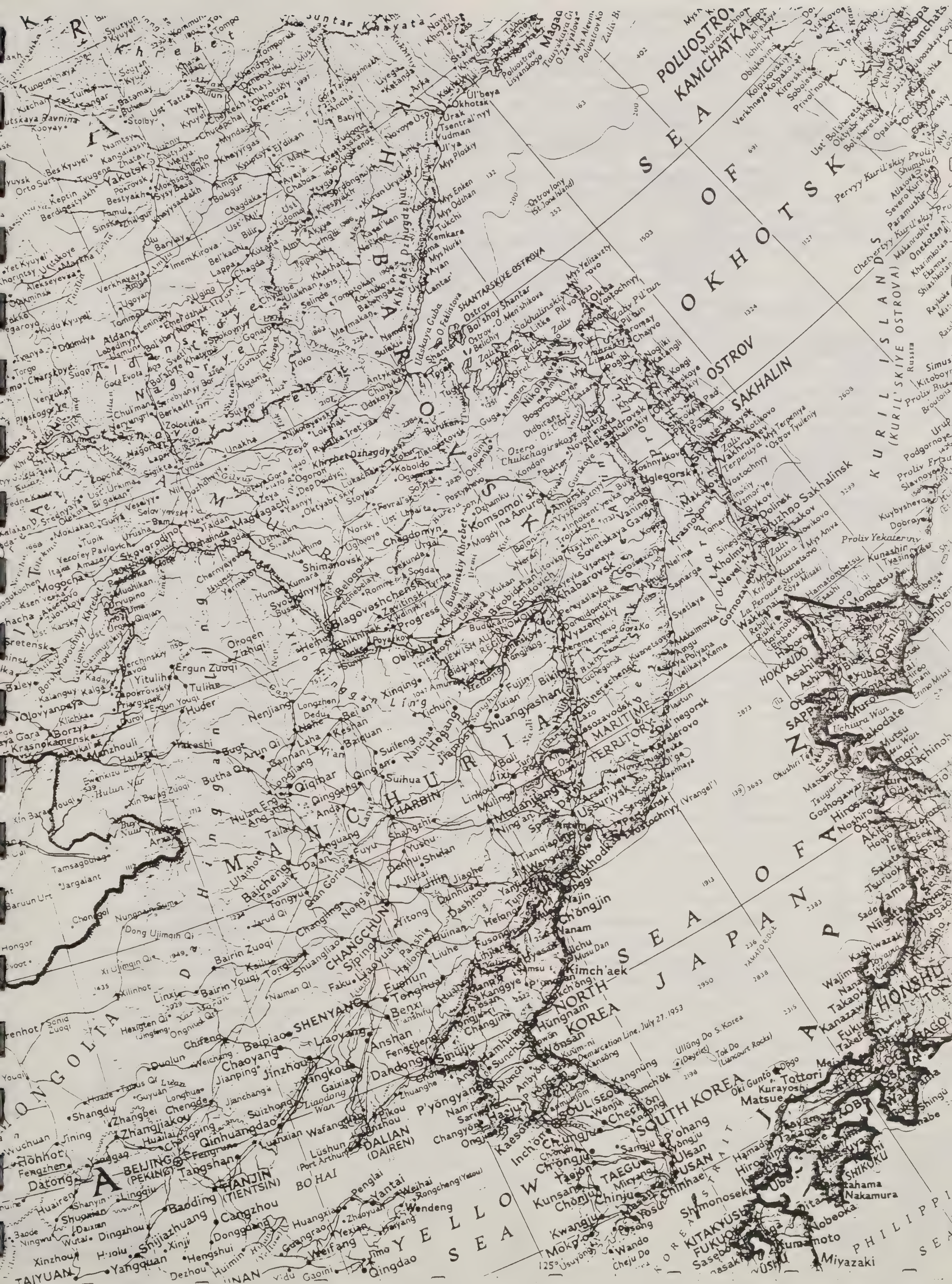
U.S.Forest Service Date

Michael C. Gregoire 7/2/93

U.S.Animal Plant Health Inspection Service Date

7.06.1993г

Federal Forestry Service of Russia Date


SEA OF OKHOTSK
POLUOSTROV KAMCHATKA
SEA OF JAPAN
YELLOW SEA
BO HAI
KURIL ISLANDS (KURIL'SKIYE OSTROVA)
OSTROV SAKHALIN
SHANTARSKIYE OSTROVA
MANCHURIA
MONGOLIA
NORTH KOREA
SOUTH KOREA
HOKKAIDO
HONSHU
SHIKOKU
KYUSHU
JEWISH AUTONOMOUS REGION
MARITIME TERRITORY
Demarcation Line, July 27, 1953
Khrebet Dzhagdy
Bureinskiy Khrebet
Yakutsk
Okhotsk
Ayan
Nikolayevsk-na-Amure
Komsomol'sk-na-Amure
Khabarovsk
Blagoveshchensk
Skovorodino
Svobodnyy
Shimanovsk
Birobidzhan
Sovetskaya Gavan'
Vanino
Aleksandrovsk-Sakhalinskiy
Uglegorsk
Yuzhno-Sakhalinsk
Kholmsk
Nevel'sk
Korsakov
Poronaysk
Okha
Ussuriysk
Nakhodka
Artem
Dal'negorsk
Severo-Kuril'sk
Petropavlovsk-Kamchatskiy
Magadan
Harbin
Qiqihar
Mudanjiang
Jiamusi
Changchun
Jilin
Shenyang
Fushun
Anshan
Dandong
Dalian (Dairen)
Lüshun (Port Arthur)
Beijing (Peking)
Tianjin (Tientsin)
Tangshan
Qinhuangdao
Shijiazhuang
Baoding
Taiyuan
Datong
Hohhot
Zhangjiakou
Chifeng
Qingdao
Yantai
Weifang
Jinzhou
Yingkou
Manzhouli
Hailar
Chita
Sretensk
Ch'ongjin
Hamhŭng
Hŭngnam
Wŏnsan
P'yŏngyang
Sinŭiju
Kaesŏng
Seoul
Inch'ŏn
Taejŏn
Taegu
Pusan
Kwangju
Mokp'o
Ulsan
P'ohang
Kangnŭng
Ullŭng Do
Tok Do (Liancourt Rocks)
Cheju Do
Sapporo
Asahikawa
Hakodate
Aomori
Akita
Niigata
Sendai
Kanazawa
Toyama
Tottori
Matsue
Hiroshima
Kobe
Osaka
Kyoto
Nagoya
Kitakyushu
Fukuoka
Nagasaki
Kumamoto
Miyazaki
Nobeoka
Shimonoseki
Kochi
Muroran
Wakkanai
La Perouse Strait
Proliv Tatarskiy
Zaliv Terpeniya
Ostrov Iony (St. Jona Island)
Rebun
Rishiri
Kunashir
Iturup
Urup
Simushir
Paramushir
Shumshu
Onekotan

RUSSIA
SEA OF JAPAN
NORTH KOREA
SOUTH
Ozero Khanka
Ussuriysk
Vladivostok
Nakhodka
Partizansk
Arsen'yev
Spassk Dal'niy
Lesozavodsk
Dal'negorsk
Rudnaya Pristan'
Zaliv Petra Velikogo
Mudanjiang
Hailin
Ning'an
Muling
Linkou
Mishan
Lianzhushan
Hulin
Boli
Suifenhe
Hunchun
Yanji
Ch'ŏngjin
Kyŏngsŏng
Kimch'aek
Tanch'ŏn
Mukhojin-ni
Samch'ŏk
Ulchin
ULLŪNG DO (DAGELET) S. Korea
Tok Do (Liancourt Rocks)
YAMATO RISE
NOTO HANTO
Toyama Wan
Suzu Misaki
Hegura Jima
Nanatsu Shima
The Democratic People's Republic of Korea is referred to as North Korea. The Republic of Korea is known as South Korea.
July 27 1953

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Male Moth Captures in Pheromone Traps

For Period Starting: 29.07.93 (month/day/year) and Ending On: 05.08.93 (month/day/year)

Agency (circle one): Russian Federal Forest Service / Plant Quarantine

Port (circle one): Vladivostok / Nakhodka / Vostochnyy / Ol'ga / Vanino / Petropavlosk

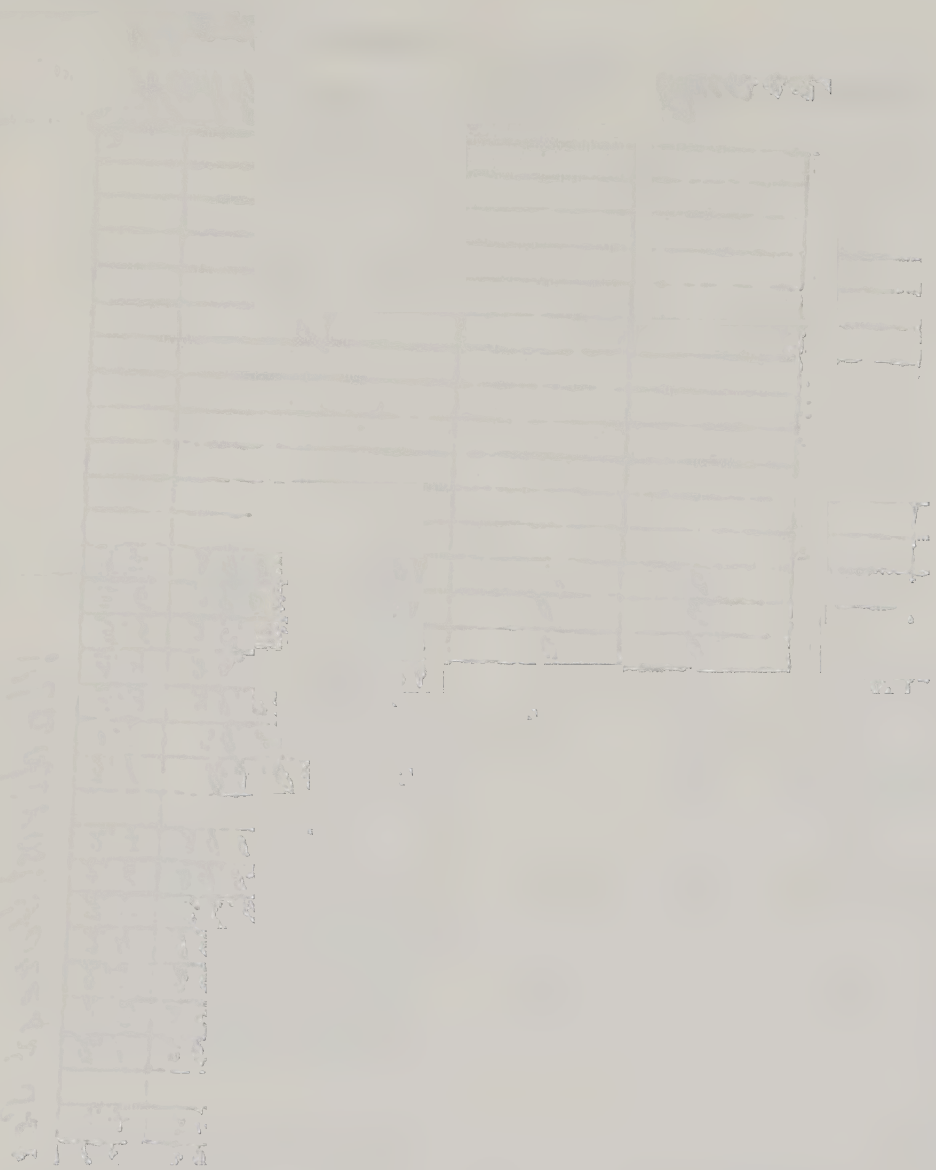
Vladivostok Forest Service

Trap #	Dates Checked	# moths for all checks this period: L. dispar	L. monacha
1.1	29.07-05.08	0	0
1.2	29.07-05.08	0	0
1.3	29.07-05.08	0	0
1.4	29.07-05.08	0	1
1.5	29.07-05.08	0	0
1.6	29.07-05.08	0	1
1.7	29.07-05.08	0	0
2.1	29.07-05.08	0	0
2.2	29.07-05.08	0	4
2.3	29.07-05.08	0	4
2.4	29.07-05.08	0	1
2.5	28.07-05.08	1	0
2.6	29.07-05.08	0	0
2.7	29.07-05.08	0	0
3.1	27.07-05.08	1	0
3.2	29.07-05.08	0	0
3.3	29.07-05.08	0	1
3.4	29.07-05.08	0	0
3.5	29.07-05.08	0	0
3.6	29.07-05.08	0	0
3.7	29.07-05.08	0	0

Vostochnyy Forest Service

Trap #	Dates Checked	# moths for all checks this period: L. dispar	L. monacha
1	29.07-5.08.93	0	0
2	29.07-5.08	0	0
3	29.07-5.08	0	0
4	29.07-5.08	0	0
5	29.07-5.08	0	0
6	29.07-5.08	0	0
7	29.07-5.08	0	0
8	29.07-5.08	1	0
9	29.07-5.08	0	0
10	29.07-5.08	0	0
11	29.07-5.08	0	0
12	29.07-5.08	0	0
13	29.07-5.08	0	0
14	29.07-5.08	0	0
15	29.07-5.08	0	0
16	29.07-5.08	0	0
17	29.07-5.08	0	0
18	29.07-5.08	0	0
19	29.07-5.08	0	0
20	29.07-5.08	0	0

Nakhodka, Vladivostok } Plant Quarantine - no male



1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Trap Record: Male Moth Captures in Pheromone Traps

Agency (circle one): Russian Federal Forest Service / Plant Quarantine

Port (circle one): Vladivostok / Vostochnyy / Vanino / Nakhodka / Ol'ga / Petropavlosk

Trap Number: ____________ **'Date trap installed:** ____________ (month/day/year)

Date Checked	Trap Condition Code	# of moths since last check: *L. dispar*	# of moths since last check: *L. monacha*

Trap Condition Codes

1. Undamaged
2. Trap missing since last check - trap replaced
3. Trap missing since last check - trap not replaced

Season Totals

L. dispar	*L. monacha*

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Male Moth Captures in Pheromone Traps

For Period Starting: ____________________ and Ending On: ____________________

(month/day/year) (month/day/year)

Agency (circle one): Russian Federal Forest Service Plant Quarantine

Port (circle one): Vladivostok Vostochnyy Vanino

Nakhodka Ol'ga Petropavlosk

Trap #	Dates Checked	# moths for all checks this period		Trap #	Dates Checked	# moths for all checks this period	
		L. dispar	*L. monacha*			*L. dispar*	*L. monacha*

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Light Trap Record

Agency (circle one): Russian Federal Forest Service   Plant Quarantine

Port (circle one): Vladivostok   Vostochnyy   Nakhodka

Trap Number: ____________   **Date Trap Installed:** ____________ (month/day/year)

Date Checked	Number of moths since last check				Date Checked	Number of moths since last check			
	L. dispar	*L. monacha*	*L. mathura*	Other		*L. dispar*	*L. monacha*	*L. mathura*	Other

Total moths all season			
L. dispar	*L. monacha*	*L. mathura*	Other

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Moth Captures in Light Traps

For Period Starting: _____ (month/day/year) **and Ending On:** _____ (month/day/year)

Agency	Port	Trap #	Check Dates	Number of moths for all checks this period			
				L. dispar	*L. monacha*	*L. mathura*	*Other*
Quarantine	Vladivostock						
		Subtotal: Number of moths by port					
Quarantine	Nakhodka						
		Subtotal: Number of moths by port					
Quarantine	Vostochnyy						
		Subtotal: Number of moths by port					
Forestry							
		Subtotal: Number of moths by port					
Forestry							
		Subtotal: Number of moths by port					

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Egg Mass Survey Record for Ports

(egg masses counted on square meter surfaces)

Port (circle one): Vladivostok Vostochnyy Nakhodka

Sample Surface #: ______ Size: ______ (square meters) Date Surface Installed: ______ (month/day/year)

Date	Number of egg masses since last check				Date	Number of egg masses since last check			
Checked	*L. dispar*	*L. monacha*	*L. mathura*	Other	Checked	*L. dispar*	*L. monacha*	*L. mathura*	Other

Total egg masses all season			
L. dispar	*L. monacha*	*L. mathura*	Other

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Egg Masses on Square Meter Surfaces

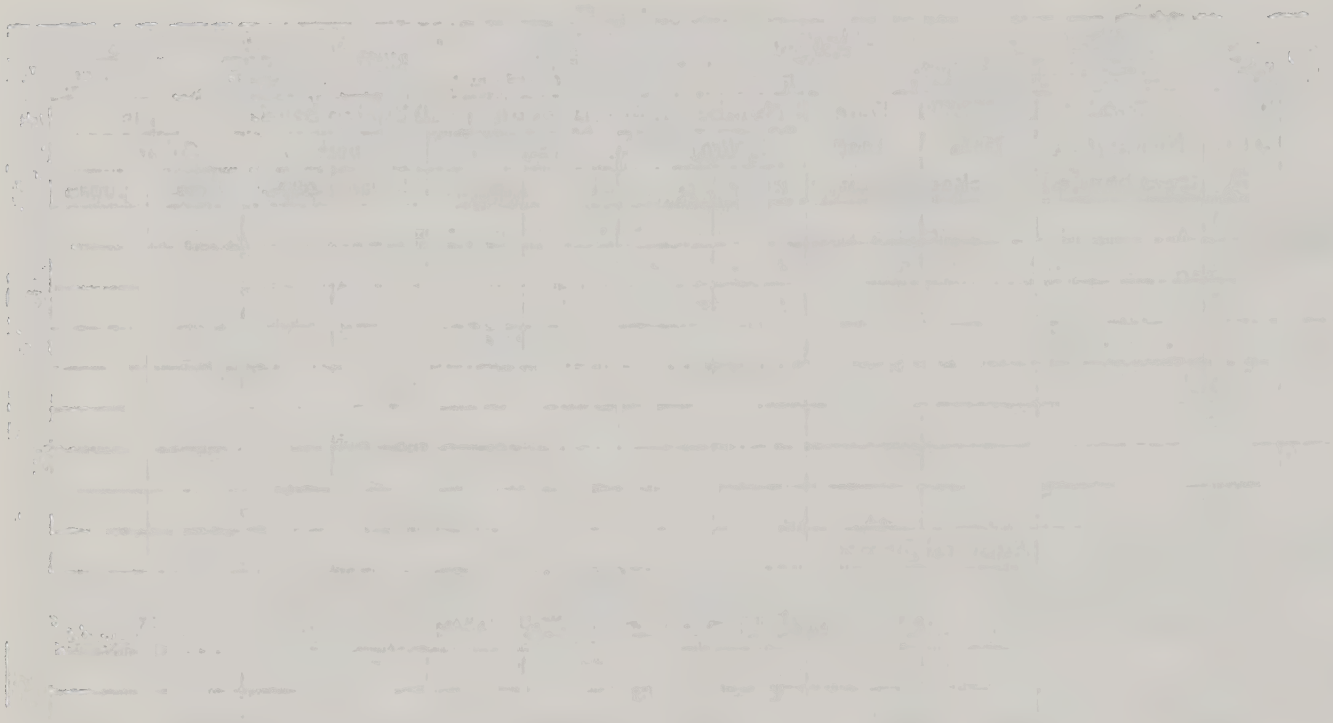
For Period Starting: _____ (month/day/year) **and Ending On:** _____ (month/day/year)

Port	Sampling Surface #	Check Dates	Number of moths for all checks this period			
			L. dispar	*L. monacha*	*L. mathura*	*Other*
Vladivostok	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
		Subtotal for Port				
Nakhodka	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
		Subtotal for Port				
Vostochnyy	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
		Subtotal for Port				

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Life Stages Under Burlap Bands

Port	Plot #	Total Number of trees banded	Date Checked	Date Last Checked	Number of life stages under all burlap bands on the plot							
					L. dispar		*L. monacha*		*L. mathura*		Other	
					larvae	pupae	larvae	pupae	larvae	pupae	larvae	pupae
Vladivostok	1											
	2											
	3											
	4											
	5											
	6											
			Subtotal for port									
Nakhodka	1											
	2											
	3											
	4											
	5											
	6											
			Subtotal for port									
Vostochnyy	1											
	2											
	3											
	4											
	5											
	6											
			Subtotal for port									



1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Life Stages Under Burlap Bands

Port	Plot #	Total Number of trees banded	Date Checked	Date Last Checked	Number of life stages under all burlap bands on the plot							
					L. dispar		*L. monacha*		*L. mathura*		Other	
					larvae	pupae	larvae	pupae	larvae	pupae	larvae	pupae
Vladivostok	1											
	2											
	3											
	4											
	5											
	6											
			Subtotal for port									
Nakhodka	1											
	2											
	3											
	4											
	5											
	6											
			Subtotal for port									
Vostochnyy	1											
	2											
	3											
	4											
	5											
	6											
			Subtotal for port									

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Light Trap Record

Agency (circle one): Russian Federal Forest Service Plant Quarantine

Port (circle one): Vladivostok Vostochnyy Nakhodka

Trap Number: ________________ Date Trap Installed: ________________ (month/day/year)

Date Checked	Number of moths since last check			
	L. dispar	*L. monacha*	*L. mathura*	Other

Date Checked	Number of moths since last check			
	L.dispar	*L.monacha*	*L.mathura*	Other

Total moths all season			
L. dispar	*L. monacha*	*L. mathura*	Other

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Moth Captures in Light Traps

For Period Starting: _____ **and Ending On:** _____
(month/day/year) (month/day/year)

Agency	Port	Trap #	Check Dates	Number of moths for all checks this period			
				L. dispar	*L. monacha*	*L. mathura*	*Other*
Quarantine	Vladivostock						
		Subtotal: Number of moths by port					
Quarantine	Nakhodka						
		Subtotal: Number of moths by port					
Quarantine	Vostochnyy						
		Subtotal: Number of moths by port					
Forestry							
		Subtotal: Number of moths by port					
Forestry							
		Subtotal: Number of moths by port					

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Trap Record: Male Moth Captures in Pheromone Traps

Agency (circle one): Russian Federal Forest Service Plant Quarantine

Port (circle one): Vladivostok Vostochnyy Vanino Nakhodka Ol'ga Petropavlosk

Trap Number: ____________ **'Date trap installed:** ____________________
(month/day/year)

Date Checked	Trap Condition Code	# of moths since last check	
		L. dispar	*L. monacha*

Trap Condition Codes
1. Undamaged
2. Trap missing since last check - trap replaced
3. Trap missing since last check - trap not replaced

Season Totals	
L. dispar	*L. monacha*

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Weekly Summary: Male Moth Captures in Pheromone Traps

For Period Starting: ____________________ **and Ending On:** ____________________

(month/day/year) (month/day/year)

Agency (circle one): Russian Federal Forest Service Plant Quarantine

Port (circle one): Vladivostok Vostochnyy Vanino

Nakhodka Ol'ga Petropavlosk

Trap #	Dates Checked	# moths for all checks this period		Trap #	Dates Checked	# moths for all checks this period	
		L. dispar	*L. monacha*			*L. dispar*	*L. monacha*

1993 Lymantriid Monitoring in Russian Far-Eastern Ports

Egg Mass Survey Record for Ports
(egg masses counted on square meter surfaces)

Port (circle one): Vladivostok Vostochnyy Nakhodka

Sample Surface #:______ Size:________ (square meters) Date Surface Installed:__________ (month/day/year)

Date Checked	Number of egg masses since last check			
	L. dispar	*L. monacha*	*L. mathura*	Other

Date Checked	Number of egg masses since last check			
	L.dispar	*L.monacha*	*L.mathura*	Other

Total egg masses all season			
L. dispar	*L. monacha*	*L. mathura*	Other

Date: February 17, 1993 Prepared by: Forest Pest Management

FOREST SERVICE BRIEFING PAPER

Topic: Monitoring Asian Gypsy Moth Populations in Russia

For: USDA Gypsy Moth Working Group

Key Points:

- APHIS and the Forest Service are planning an AGM population monitoring program in the Russian far east.
- Trade between the US and Russia is increasing. Exotic forest pests can be introduced to new areas when they are transported along with items of trade. The climate, forests, and forest pests are similar in the two countries.
- The Asian variety of gypsy moth, native to Russia, is a potentially more destructive pest than the European gypsy moth already in this country. The pink gypsy moth and the nun moth also pose a threat to U.S. forests.
- Last year almost $20 million was spent on eradicating Asian gypsy moths accidentally introduced near the ports of Oregon and Washington. This year costs will be $6 million for follow-up surveys.
- A pre-introduction, pro-active program for the Asian gypsy moth is more cost effective than a post-introduction, reactive program.
- In the summer of 1992 officials from USDA and Canadian agricultural and forestry organizations visited Russia and opened discussions regarding the Asian gypsy moth and international transport.
- Following that visit a package of proposals was developed for AGM research, survey, control and regulatory activities. The following agencies are participants in these cooperative proposals with Russia: FS-FPM, FS-FIDR, APHIS, ARS, Forestry Canada, and Agriculture Canada.
- Deputy Chief Overbay and Associate Deputy Chief Harcharik discussed the monitoring proposal on a visit to Moscow in December.
- The Forest Service and APHIS are in the process of signing a Memorandum of Understanding to design and implement a survey plan to monitor Asian gypsy moth populations in Russia. The FS is planning for forested areas around the ports, while APHIS is planning for the ports themselves.
- Asian gypsy moths are native to the forests near the ports of Nakhodka, Vostochnyy, and Vladivostok. Female moths are attracted to the lights of the ports and lay their eggs on the ships. Russian ships leaving far eastern ports during periods of moth flight are prohibited from entering western North American ports.

- A FS/APHIS technical team will travel to Moscow in early March to meet with the Russian Federal Forest Service.

- In April a final agreement with specific expectations and responsibilities will be signed with the Russians in Moscow.

- During the summer the technical team will return to Russia and observe the monitoring system in operation at the far eastern ports.

- Key project objectives are: 1. Develop a system to assess and reduce risk of AGM introduction, 2. Gather information to determine when control measures are needed to reduce populations in and around ports, 3. Determine when ships are at risk of infestation, 4. Track population levels in and around ports, 5. Use survey results to trigger mitigation measures, 6. Open lines of technology and information transfer regarding pest risk assessment and control.

- Technical aspects of the survey for the forests: 2 km grid of pheromone traps; burlap bands on all trees in a .01 hectare plot around trap trees (7 cm or greater); egg mass surveys.

- Technical aspects of the survey for the ports: 5 light traps/port; 10 pheromone traps/port; 12 egg mass monitoring stations.

Win McLane

A Report to the National Steering Committee
for Gypsy Moth and Other Eastern Defoliators

Win McLane

USDA, APHIS, PPQ
Otis Methods Development Center
Building 1398
Otis ANGB, MA 02542
508-563-9303
FAX 508-564-4398

A very limited number of materials were screened against gypsy moth larvae in the laboratory. Twelve *Bacillus thuringiensis* samples were screened with some demonstrating good activity against gypsy moth. No materials were tested in the field against gypsy moth larvae. This was do to a lack of suitable materials to test, poor quality of infestations and commitment to other projects such as pine shoot beetle, Japanese beetle and apple ermine moth.

The testing of Golden Natur'l Spray Oil for use on gypsy moth egg masses was completed.

Ten applications were applied to field egg masses in Massachusetts between September 10, 1992 and April 16, 1993. Twenty egg masses were treated with each dosage tested. Treated egg masses were left in the field until late April, when they were removed to the laboratory for hatchability results.

Percent Tested	Hatch
5	Light hatch on 8 of 10 treatments
10	Light hatch on 4 of 10 treatments
15	No hatch
25	Light hatch on 1 of 200 egg masses
50	Light hatch on 1 of 200 egg masses
100	No hatch
Control	Complete hatch on all egg masses

Percent hatch of gypsy moth egg masses treated with Golden Natur'l Spray Oil, 1991 - 1992 (McLane, Finney).

Formulation	Treatment Dates					
	1/29/92	2/21/92	3/10/92	3/26/92	4/8/92	4/22/92
100%[a/]	0	0	0	0	0	0
50%[b/]	0	0	0	0	0	0
25%[c/]	0	0	0	0	0	0
5%[d/]	21[e/]	4	7	5	6	3
Control	90[e/]	90	90	90	90	90

[a/] Used undiluted, 100 percent of concentration
[b/] 50 percent of concentrated formulation
[c/] 25 percent of concentrated formulation
[d/] 5 percent of concentrated formulation
[e/] Estimated hatch

As a result of these data, Golden Natur'l Spray Oil was registered for use against gypsy moth egg masses.

Golden Natur'l Spray oil is recommended for application to gypsy moth egg masses to prevent hatch of eggs. Treat egg masses that have been deposited on trees, ground litter, outdoor furniture, recreation vehicles, firewood, nursery stock, rocks, vessels, aircraft and other forms of transportation. Treat egg masses between August and May.

Mixing Directions

Mix equal amounts of Golden Natur'l Spray oil and water and apply to egg masses as a 50 percent mix. Make a new mix each day treatments are made.

Application Technique

With use of a small hand sprayer, treat individual egg masses until they are completely saturated with the spray solution. Keep the mix agitated while treating. General application by mist blower, hydraulic sprayer or aircraft is not recommended. It is important that the egg mass is saturated with the spray. Following treatment, egg masses can be left in place or removed and incinerated.

Do not exceed maximum rate or apply when not recommended.

EPA registration number - 57538-11
EPA establishment number - 34160-TX-1

The material is available from:

Stoller Enterprises, Inc.
8582 Katy Freeway
Houston, TX 77024
713-464-5580

Experimental laboratory work was conducted with a number of candidate stickers to identify one for use with gypsy moth pheromone flakes. The presently used RA 1990 will be phased out of production by Monsanto.

Laboratory results indicated a suitable replacement would be Gelva 2333 or Gelva 2484 made by Monsanto. They have assured us that the Gelva 2333 would be available for the future and they feel it would be a better product than Gelva 2484.

Experimental laboratory work was conducted with Shin Etsu gypsy moth pheromone chips. Initial work demonstrated its ability to stick on oak foliage when used with a sticker furnished by Shin Etsu.

The release rate of Shin Etsu chips appears to be similar to that of AgriSense beads (Leonhardt).

Hercon flakes, AgriSense beads and Shin Etsu chips were tested in Virginia. Flakes and beads were applied by aircraft to isolated experimental plots with low gypsy moth populations. Results are not available at this time. Chips were tested by ground equipment and aircraft, mainly to determine their sprayability and pheromone release rate. The chip formulation was sprayed by aircraft through CP spray nozzles with no problems. The formulation needs to be adjusted with a thickener to better keep the chips in suspension.

Dimilin (diflubenzuron) Review

August 1993

Win McLane

Introduction

Dimilin belongs to a novel group of insecticidal compounds, the substituted 1-benzoyl-3-phenylureas, discovered by DUPHAR B.V., Holland.

Dimilin acts by interfering with the deposition of chitin, one of the main components of the insect cuticle. After treatment with Dimilin, larvae have difficulties with moulting. The malformed cuticle of the new instar cannot withstand the internal pressure during ecdysis and/or cannot give sufficient support to the muscles involved. This results in an inability to cast the exuviae and finally leads to the death of the larva. The mode of action of Dimilin can also give rise to ovicidal effects by interfering with chitin deposition of the developing larva in the egg. Adult insects are not lethally affected. Dimilin is mainly a stomach poison, but in some cases contact toxicity is also of importance. The compound is not plant-systemic and does not penetrate into the plant tissue. Consequently, sucking insects will not, as a rule, be affected; these characteristics form the basis of a further selectivity within the order of insects. Dimilin has a high stability on plants and a favorable degradation pattern in water and in soil.

Dimilin is of low mammalian toxicity. The product should be handled and used with the normal care and caution that should be exercised in dealing with pesticides. Excessive contact should be avoided.

Much of the success of Dimilin can be attributed to its effectiveness. The unique properties of Dimilin combine with the gypsy moth's life cycle to make it a very precise and highly selective product.

As treated larvae behave and feed normally until a molt is due, some plant damage can still occur after application. But early treatment should keep this to a minimum.

Dimilin can cause ovicidal effects by contact on gypsy moth eggs or by treatment of gravid females. In both cases, the larva in the egg is fully developed and alive but, due to the chitin deficiency in the cuticle, it is either unable to hatch, or it dies soon after.

The diflubenzuron residue on plants is relatively persistent and stable. It does not enter plant cells and is not easily washed off by rain. This is an advantage as it offers long-lasting insecticidal protection to the plant while having no harmful side-effects.

Dimilin, when used according to the instructions on the label, is the most effective pesticide available against gypsy moth.

Dimilin was first tested against gypsy moth larvae at the USDA, APHIS, Otis Methods Development Center laboratory in 1973 (McLane, Laboratory Report). The material was called TH-6040 and was distributed by Thompson Hayward. Initial testing demonstrated its exceptional effectiveness against gypsy moth larvae at very low dosages.

In 1974, TH-6040 was field tested on 50 acre spray plots by USDA, APHIS in Hamden County, Massachusetts (Herbaugh, McLane Laboratory Report, July - December, 1974). Dosages of .3 lbs. AI/gallon/acre (5 oz. AI) and .06 lbs. AI/gallon/acre (1 oz. AI) were tested and resulted in 100 percent population reduction based on pre- and post-egg mass counts. It was noted that mortality did not occur until about 6 days post-treatment.

In early 1975, TH-6040 was given the name Dimilin. At this time two formulations were available for experimental testing, Dimilin 25W and Dimilin 2F.

Laboratory and field testing of Dimilin 25W continued during 1975. Laboratory studies (McLane, Laboratory Reports, January - August, 1975 and September - March 1975-1976) confirmed its ability to resist wash-off when exposed to rainfall as well as its efficacy at low dosages.

Field tests (Herbaugh and McLane, Laboratory Report, September, 1975 - March, 1976) demonstrated its effectiveness against early 2nd instar gypsy moth with larvae at dosages of .03 lbs. AI/acre (.5 oz. AI) and .015 lbs. AI/acre (.25 oz. AI).

During the early and mid seventies there were less than desirable results being achieved with most application of *Bacillus thuringiensis*, Bt. The state of Pennsylvania continued to use Trichlorfon (Dylox) and some carbaryl (Sevin) was used by states like New Jersey.

Mainly through the efforts of the USDA, APHIS, Otis Methods Development Center laboratory and John Kennedy, APHIS, Hyattsville staff officer, Dimilin 25W was registered for gypsy moth control on April 19, 1976.

Uniroyal Chemical Company started marketing Dimilin in 1981. Thompson Hayward were no longer involved with the development or sales of Dimilin.

In 1978, approximately 2,500 acres of isolated gypsy moth infestation was treated with two applications of Dimilin 25W in San Jose, California. The treatments were applied at .03 lbs./AI gallon/acre (.5 oz. AI) and resulted in 100 percent control based on post-treatment pheromone trapping surveys.

Six hundred acres were treated with two applications of Dimilin 4L for gypsy moth eradication in northwest Arkansas during 1993. Populations in the core (10 acres) area averaged about 10,000 egg masses per acre. The material was applied by helicopter at .03 lbs. AI/gallon/acre and gave excellent control results within the treatment area. No larvae were found under burlap (150 trees in core area) placed around trees during the post-treatment larval period. Only one male moth was captured by pheromone traps (60 traps) during the flight period following the treatments.

During the past 17 years, Dimilin 25W and more recently Dimilin 4L (past 3 years) have been used in gypsy moth suppression projects in the northeastern United States. For the past 10 years, nearly half of the total acres treated for suppression projects have been sprayed with Dimilin (Twardus, Database, 1993). However, less Dimilin has been used in recent years (past 3) because of its disputed effect on the environment.

From the time of registration until present, Dimilin has continued to be evaluated. Studies conducted include its effects on non-target insects, effects on aquatics, its residual, wash-off characteristics, efficacy, evaporation, drift and formulation evaluation, to name a few.

Presently Dimilin can be used to protect trees and shrubs against gypsy moth in such areas as:

- Forests
- Residential, municipal and shade tree areas
- Recreational areas, such as campgrounds, golf courses, parks, parkways
- Ornamental, shade tree and forest nurseries
- Forest plantings
- Shelterbelts
- Rights of way and other easements

Dimilin is a restricted use pesticide, mainly because of its effects an aquatics.

Dosage/Rate Used

Both Dimilin 25W (EPS Reg. No. 37100-8-400) and Dimilin 4L (EPA Reg. No. 37100-54-400) are registered for use at .25 to 1.0 ounces of active ingredient per acre when used against gypsy moth larvae. This amounts to 1-4 ounces and .5 to 2 ounces of formulation, respectively.

The active ingredient of Dimilin 25W is 25 percent with 75 percent being inert ingredients. With Dimilin 4L, the active ingredient is 40.4 percent with 59.6 percent inert ingredients.

Dimilin 25W

Insect	Rate Dimilin 25W Per Acre	Timing	Spray Volume Per Acre-Gallons		
			Aerial	Ground	
				Air Blast	Hydraulic
Gypsy Moth	1-4 oz.	Early instar (1st, 2nd or 3rd preferred, but prior to full leaf expansion.	0.5-2.5	5-20	100-400

Dimilin 4L

Insect	Rate Dimilin 4L Per Acre	Timing	Spray Volume Per-Gallons		
			Aerial	Ground	
				Air Blast	Hydraulic
Gypsy Moth	0.5-2 oz.	Early instar (1st, 2nd or 3rd) preferred, but prior to full leaf expansion.	0.5-2.5	5-20	100-400

For standard suppression programs, no more than one application is allowed per year. For quarantine programs, two applications are allowable but total amount applied per season should not exceed 2 ounces of Dimilin 4L or 4 ounces of Dimilin 25W.

In nearly all suppression programs and private spray programs, Dimilin has been used at .03 lbs. AI (.5 oz. AI)/gallon/acre. This requires 2 ounces of Dimilin 25W or 1 ounce of Dimilin 4L per acre. For eradication projects, the material has been applied at .03 lbs. AI (.5 oz. AI)/gallon/acre using 2 applications 7 to 14 days apart. Both techniques have been very effective at controlling extremely light and heavy population of gypsy moth larvae.

There have been a number of laboratory studies and some field studies using lower dosages and rates.

Laboratory (Otis)

Dosage/Rate	Mortality	Reference
.0001 lbs. AI/A (.0017 oz. AI)	75%	McLane, Lab. Reports October - March 1977-1978
.0009 lbs. AI/A (.015 oz. AI)	100%	McLane, Lab. Reports April - September 1977
.003 lbs. AI/A (.062 oz. AI)	100%	McLane, Lab Reports September - March 1975-1976

Numerous laboratory studies similar to the ones reported have been done at the Otis Methods Development Center, USDA, APHIS. All demonstrate excellent efficacy (100 percent mortality) at one-hundredth of an ounce when newly moulted 2nd instar larvae are exposed to treated oak seedlings.

Field studies have demonstrated that Dimilin can be applied effectively at .03 lbs. AI (.5 oz. AI) using reduced volumes of application.

Field (Otis)

Dosage/Rate	Population Reduction	Reference
.03 lbs. AI/.5 gal./A (.5 oz. AI)	100.%	Herbaugh, McLane Lab. Reports April - Sept. 1977
.03 lbs. AI/.25 gal./A (.5 oz. AI)	. 99.%	McLane, Lab. Reports April - September 1979
.03 lbs. AI/.5 gal./A (.5 oz. AI)	99.%	McLane, Lab. Reports October 1987 - September 1988
.03 lbs. AI/.25 gal./A (.5 oz AI)	99.6%	McLane, Lab. Reports October 1987 - September 1988
.03 lbs. AI/.125 gal./A (.5 oz. AI)	94%	McLane, Lab. Reports October 1987 - September 1988
.03 lbs. AI/.25 gal./A (.5 oz. AI)	99%	McLane, Lab. Reports October 1988 - September 1989
.03 lbs. AI/.125 gal./A (.5 oz. AI)	100%	McLane, Lab. Reports October 1988 - September 1989
.03 lbs. AI/.25 gal./A (.5 oz. AI)	100%	McLane, Report to Uniroyal
.03 lbs. AI/.125 gal./A (.5 oz. AI)	100%	McLane, Report to Uniroyal

There has also been numerous field tests conducted where lower dosages have been used. A few are mentioned here.

Field (Otis)

Dosage/Rate	Population Reduction	Reference
.015 lbs. AI/gal./A (.25 oz. AI)	98%	McLane, Lab. Report October 1988 - September 1989
.015 lbs. AI/32 oz./A (.25 oz. AI)	99%	McLane, Lab. Report October 1988 - September 1989
.015 lbs. AI/32 oz./A (.25 oz. AI)	100%	McLane, Lab. Reports April - September 1979
.0075 lbs. AI/.5 gal./A* (.125 oz. AI)	100%	McLane, Lab. Reports April - September 1979

*Two applications

During 1990 and 1992 the Commonwealth of Pennsylvania, Department of Environmental Resources conducted work using low dosages of Dimilin. Pennsylvania has used .4 ounces per acre for their suppression programs.

In 1990, they tested .04 and .004 ounces active ingredient per acre at a rate of 128 ounces per acre (Buzzard, Report, January 1991). Foliage protection was achieved with the .04 ounce application but population reduction was such that the treatment area qualified for re-treatment the following year. As a result of this study, Pennsylvania's standard dosage was reduced to .25 ounces for 1991.

In 1991, .125 ounces AI were tested and compared to the new standard of .25 ounces AI per acre. Successful treatment was defined as defoliation below 30 percent and post-spray egg mass counts below 500 per acre (Buzzard, Report, January 1991).

The .125 ounce AI treatment resulted in 86 percent population reduction and good foliage protection but post-spray egg masses (579) qualified the area for re-treatment in 1992.

During the 1992 Pennsylvania gypsy moth suppression project, the efficacy of two reduced dosages of Dimilin 25W (.125 and .187 oz. AI/A) were compared with the standard operational dosage of .25 oz. AI/A.

The .25 and .187 oz. AI/A treatments gave good population reduction at 95 and 92 percent respectively. The .125 oz. AI/A gave 84 percent population reduction.

Extensive laboratory studies at low dosages and the limited field work would certainly indicate that Dimilin can be applied in suppression projects at a much lower dosage than is presently used. If applied properly, there is no reason that Dimilin should not be

applied at .25 oz. AI/acre or lower. All efficacy data indicate that if the material is on the foliage, dosages as low as .01 ounces of active ingredient will work.

There is excellent field data that can support rates of .5 gallons per acre or less if applied properly. Three years of testing by McLane resulted in excellent population reduction when applied at .5 oz. AI in 16 ounces per acre.

Therefore, it would appear that the field efficacy is only as good as the application. If states are willing to enforce the guidelines developed for proper spray techniques, Dimilin can successfully be used at .25 oz. AI/acre or less. Most likely, for suppression projects, application could be made at dosages less than .25 oz. AI/acre. However, if they are not willing to enforce and abide by the rules the dosage should stay at .5 oz. AI/acre.

It is recommended that APHIS, FS and the states cooperate in additional development work with Dimilin at dosages lower than .25 oz. AI/acre and with rates lower than 96 oz./acre.

Mode of Action

Chitin is a colorless mitrogenous polysaccharide chemical compound intermediate between proteins and carbohydrates that is necessary in aiding the gypsy moth moulting process. The loss of chiten will cause the outer skin to develop improperly and rupture from internal pressure causing larval death at moulting time.

Dimilin is a Chitin inhibitor that is absorbed by intake through the stomach and by contact. Therefore, it is important to achieve good spray coverage on the target foliage.

Its contact effect is not fast acting such as that with the synthetic pyrethroids. Mortality will not occur in a mater of hours but will take place in 5 to 7 days, similar to the effects of its being taken through the stomach.

Because of the time period between ingestion and/or contact with Dimilin and actual mortality, some additional defoliation can occur. However, in most cases, its minimal.

Gypsy moth larvae are not apt to fall to the ground immediately after death resulting from Dimilin poisoning. Often they will remain hanging from the leaves until dis-lodged by wind and/or rain.

Late instar gypsy moth larvae and pupae can also be effected by late season applications of Dimilin (see insect size and foliage development).

Application

Dimilin can be applied by fixed wing aircraft, helicopter or ground equipment such as mist blowers or hydraulic sprayers. In some cases, mixing can be done in aircraft, however, it is best to mix in a nurse tank and then transfer the ready mix to the spray aircraft. Proper safety equipment should be used when mixing and handling Dimilin (see label). Droplet VMD (volume mean diameter) should be between 150 and 250 microns. Droplets smaller than 100 micron size should not be used so evaporation and off target drift can be minimized.

Swath widths will vary depending on the type and size of aircraft being used (see APHIS assigned swath widths). Small aircraft will normally use a swath of 75 to 100 feet (Cessna Ag-trucks, Bell 47) with larger aircraft using 100 to 300 feet (DC3, Martin 404). Speed of aircraft will range from 60 to 160 mph. The spray is normally applied between 50 and 75 feet over the tops of the target trees. Do not apply at heights greater than 75 feet as excessive evaporation will occur.

It has been standard procedure to apply Dimilin using diaphragm check valve nozzle bodies (Spraying System Company, Ct. 41, Type 4664B) and standard flat spray tips (Spraying Systems Company, Cat. 41, Tee Jet). Proper strainers (50 mesh) should also be used when applying Dimilin (Spraying Systems Company, Ct. 41, No. 6051-SS). There should be an in-line strainer on the nurse tank and aircraft as well as one for each nozzle. Dirt will normally occur on strainers near the end of the spray boom first. Loss of system pressure often means the main in-line strainer is clogged.

Dimilin has been applied through Micronair rotary atomizers (Maryland) and through a Micromist 900 system (Jeff DuFlo, Spray-Chemical Inc., 1991 in New York).

Although the results of these applications were generally good, one should be very concerned about using these types of equipment to apply Dimilin. The applications of Dimilin are made with mainly water and a very small percentage of active ingredient, therefore, sufficient evaporation can often occur. If rotary atomizers are used, they should be characterized before spraying starts. The atomizers should be adjusted to produce droplets of about 150-250 microns.

Experimental work needs to be conducted with the application of Dimilin 25W and Dimilin 4L using rotary systems. Suppression and eradication application of Dimilin should not be authorized using these types of atomizers until more characterization work is done with each individual system.

For mixing, add powder or flowable to water as it is being agitated and continue to agitate in nurse tank and aircraft until sprayed. If the mix is allowed to sit for 10 minutes without agitation most powder and flowable (Dimilin) will settle to the bottom and require moderate agitation to re-suspend. If allowed to sit over-night, the material will form a hard cake on the bottom of the tank. If this happens very vigorous agitation is required before all the material will go back into suspension. Make sure the aircraft being used has a good agitation system and it is used between the airport and spray plot.

Dimilin 4L is a more desirable formulation to work with and it will stay in suspension more readily than Dimilin 25W.

When properly applied, Dimilin will give 98 to 100 percent population reduction based on pre- and post-egg mass counts.

Insect Size and Foliage Development

It is standard procedure to spray Dimilin when gypsy moth larvae are late 1st and early 2nd instar. At this time, general foliage expansion should be about 25 percent. White oak may only be expanded to 5 percent or less at this time. So in areas where white oak is the dominate species, spray may be applied somewhat later.

If one wishes to apply Dimilin when larvae are late 1st and early 2nd instar, they should check larvae size daily and not go by foliage development.

One major benefit in using Dimilin is its good efficacy against early and late instar larvae (McLane, Lab. Reports, October 1980 - September 1981). If large acreage is sprayed and/or weather conditions are bad, Dimilin can still be effectively applied and efficacious over a much longer time period than *Bacillus thuringiensis*.

Pre-hatch and pre-foliage applications have been tested and found to be very effective (McLane, Lab Report, October 1985 - September 1986, October 1986 - September 1987 and October 1987 - September 1988). It is possible to apply Dimilin at the first sign of hatch or at general hatch and achieve good efficacy. However, this would normally not be done unless excessive acreage was to be sprayed with limited aircraft. One disadvantage of early Dimilin spraying is the fact that more material will land on the ground and possibly contaminate water and ground litter.

Late instars such as 3rd, 4th and 5th instar larvae can be treated resulting in effective population reduction. However, in moderate to heavy populations excessive defoliation may have already occurred when larvae reach this stage.

There is little, if any, additional work that needs to be conducted in this area. If early (pre-foliage) treatments were to become common, it certainly would be advisable to continue environmental impact studies as pertains to contamination of water and forest litter. Most of this work is on-going and is taking place anyway.

Weatherability of Dimilin

The ability of a product to withstand removal from foliage by rainfall becomes very important and sometimes critical to the success of a product in the forestry market. This becomes particularly evident in large operational programs, when the window of application is short or when there are extended periods of inclement weather. Several studies to determine rain fastness of Dimilin 25W and Dimilin 4L have been conducted

on both deciduous and evergreen foliage. Studies done using gypsy moth as an assay organism indicated that essentially complete activity is maintained even after 5 inches of simulated rainfall was applied shortly after Dimilin application. Little data are available to show quantitatively the removal by rain of the spray deposit from deciduous foliage. However, the studies, along with many years of good performance in the field, following rainfall indicates that the weatherability of Dimilin 25W and Dimilin 4L on foliage is excellent.

Oak Seedlings - Greenhouse 1975

Rate - Dimilin 25W 1, 2 and 4 oz. per acre.

Method - Treated seedlings were subjected to 1, 2, 3, 4 and 5 inches of simulated rainfall 1 hours after treatment

Bioassayed using Gypsy Moth, Lymantria dispar

Amount Simulated Rainfall	Mortality at 10 to 13 days		
	Rate 4 oz/gal/A	2 oz/gal/A	1 oz/gal/A
5 inches	98	98	97
4 inches	100	100	100
3 inches	90	82	84
2 inches	95	82	81
1 inch	98	93	99

USDA, APHIS, W. McLane

Oak Seedlings, Greenhouse 1987

Rainfall - simulated

Rate - Dimilin 25W 2 oz. per acre

Method - Treated seedlings were subjected to 0, 1, 2 and 3 inches of simulated rainfall

Bioassayed using Gypsy Moth, Lymantria dispar

Inches Rainfall	% Mortality 7 Days
0	98
1	98
2	100
3	100

USDA, APHIS, W. McLane

Percent mortality of 2nd instar gypsy moth larvae following exposure to oak foliage treated with 3 Dimilin formulations at .0312 lbs. AI/gal./acre.

Formulation	Inches Rain	After 7 Days Mortality
25W	-	98
	1.0	98
	2.0	100
	3.0	100
2F	-	96
	1.0	98
	2.0	99
	3.0	100
4L	-	99
	1.0	100
	2.0	98
	3.0	100
	-	0
Check	3.0	4

USDA, APHIS, W. McLane

Dimilin can be very efficacious when applied to wet foliage (McLane, Lab Reports, October 1988 - September 1989). Often ideal spray time is lost because of wet foliage as a result of rain or dew. Before applying *Bacillus thuringiensis*, dry foliage would be required. Although not recommended as standard practice, Dimilin can be applied to wet foliage if time is a factor.

Percent mortality of 2nd instar larvae following an 8-day exposure to oak seedlings treated with Dimilin on various degrees of wet foliage.

Formulation	Dosage/Rate Acre	Foliage Degree of Wetness	Percent Mortality
Dimilin 25W	.03 lbs./gal.	Dry	100
Dimilin 25W	.03 lbs./gal.	Wet to point of run-off[1/]	100
Dimilin B	.03 lbs./32 oz.	Dry	100
Dimilin B	.03 lbs./32 oz.	Wet to point of run-off[1/]	100
Dimilin C	.03 lbs./16 oz.	Dry	100
Dimilin C	.03 lbs./16 oz.	Wet to point of run-off[1/]	99
Dimilin E	.015 lbs./32 oz.	Dry	100
Dimilin E	.015 lbs./32 oz.	Wet to point of run-off[1/]	100
Control	--	Dry	2

USDA, APHIS, Win McLane
[1/]Seedlings were dripping wet at time of Dimilin application.

Most likely, Dimilin could be applied effectively up until minutes before a moderate rainfall. However, to insure a good, effective treatment, a minimum of 2 hours of drying time should be required.

Stability of Dimilin

On a number of occasions, Dimilin nurse tank mixes have been held in the field for up to one week because of bad spray weather. These mixes were mixed vigorously at the end of the holding time and sprayed out onto experimental plots. Results have always been as good as with freshly made batches (McLane). Therefore, it is not necessary to "spike" the mix, to make up for lost potency, or discard the mix. Just make sure everything is in suspension before using.

Dimilin is stable when applied to oak foliage with the half life reported by Uniroyal to be approximately 30 days.

The half life in soil would appear to be much longer. In some cases, gypsy moth larval mortality continued to occur when larvae were exposed to soil surfaces treated with Dimilin 77 days prior to exposure (McLane, Lab. Reports, 1980-1981).

The shelf life of Dimilin 25W and Dimilin 4L appears to be good based on bioassay work by McLane at the USDA, APHIS, Methods Development Center laboratory. Therefore, material that has been in storage for up to 3 years should still be good. Samples can be sent to McLane at the Otis laboratory for efficacy tests.

Cost of Dimilin

The cost of Dimilin 25W is $30 per pound. Dimilin 25W is normally supplied in 5 pound bags, 8 per case.

Dimilin 4L costs $464 per gallon and is supplied in 2.5 gallon containers, 2 per case.

The material is supplied by:

Uniroyal Chemical
Crop Protection Division of
Uniroyal Chemical Company
74 Amity Rd.
Bethany, CT 06525
203-573-2028
203-573-3025

Remaining Studies to be Conducted

1. Continue to evaluate lower dosages and rate of application. This would include the evaluation of anti-evaporant materials.

2. Continue all on-going non-target and environmental studies. Determine where data gaps occur and initiate studies that will fill these gaps.

3. All rotary and conventional spray atomizers need to be characterized with Dimilin (Mission, TX, 1994, NEFAAT).

4. Although one or more drift studies have been conducted with Dimilin, they need to be reviewed to determine if additional work needs to be done.

5. Follow up evaluations of Dimilin treated plots (5 + years) with direct comparison to *Bacillus thuringiensis* spray plots to establish post treatment population trends.

Conclusions

All laboratory and field efficacy studies have determined Dimilin to be extremely efficacious when used against gypsy moth larvae. The material is effective at very low dosages and can be applied to all instars of larval development. Treatments can be applied to early hatch, with little foliage, and the material is very resistant to wash-off from rainfall.

There has never been much question concerning the effectiveness of Dimilin in controlling gypsy moth infestations. The main question has always been its effects on non-targets and the environment in general. Studies, too numerous to mention here, are presently underway to determine Dimilin's fate in the environment. It is important that such studies continue as well as new ones initiated.

Because of these environmental concerns, it is advantageous for Uniroyal and Dimilin users to apply the lowest dosages possible that still give desirable results. Pennsylvania is presently doing this and other states will be required to do the same if they want to continue to use Dimilin. Over the long haul, this will still mean profit for Uniroyal and availability of Dimilin for years to come.

Numerous laboratory and field tests have demonstrated the effectiveness of Dimilin at dosages and rates much lower than what are presently being used. The data support the use of standard suppression treatment dosages of .015 lbs. AI/gal/acre (.25 oz. AI/A). This dosage should be used on suppression projects starting in 1994. In addition, research should start to develop and/or demonstrate effective dosages lower than .25 oz. AI/acre. These efforts should be combined with ones designed to lower the rate of application per acre from one gallon to 64 ounces or less. If we do not do this, Dimilin may be a product of the past, and not available for gypsy moth control in the near future.

Eradication projects should continue to use two applications of Dimilin at .03 lbs. AI/gal/acre (.5 oz. AI/A) until such time that lower dosages have been demonstrated to work consistently over the long haul in suppression projects. If so demonstrated, the dosage for eradication treatments should also be lowered.

With lower dosages and rates of Dimilin being used, it will be very important that the applications be made under suitable spray conditions. This means that supervisors must monitor weather conditions, insect development, foliage development and actual applications more closely. If this is not done, lower dosages will not work consistently. Uniroyal Chemical Company's main concern about using lower dosages and rates is the spraying that takes place under conditions that are not favorable to pesticide application. If state and federal personnel are not willing to enforce the rules, lower dosages will be a failure and Dimilin will be a thing of the past.

One should be very cautious if they plan to use rotary atomizers for application of Dimilin. The formulations being mainly water, small droplets are very susceptible to evaporation. This researcher recommends that rotary atomizers not be used for

application of Dimilin until such time as proper characterization has been done with each spray system.

No stickers or additives are needed when Dimilin is applied in 96 or 128 ounces per acre. However, with rates below 96 ounces per acre, some type of anti-evaporate should be used.

Dimilin drift studies should be revived to determine if suitable data are available to satisfy drift accountability needs that EPA may require in the future. If not, these studies should be conducted.

Applications of DDT, Sevin and Dylox were applied to gypsy moth infestations using 1.0 lbs. AI/acre. Dimilin is applied at .5 ounces AI/acre. This material is a very important tool in the arsenal of products we use in controlling the gypsy moth. Hopefully, it will not be lost like other effective compounds we have had in the past.

There are many reports about Dimilin, too numerous to include as part of this brief review. These can be made available if you call Win McLane at 508-563-9303.

Gypsy Moth Suppression Projects by Year

Year	Bt	Dimilin	Sevin	Other**	Acres Treated
1970	0	0	84469	38049	122518
1971	0	0	94310	0	94310
1972	0	0	75229	0	75229
1973	0	0	47443	43484	90927
1974	0	0	69753	104258	174011
1975	0	0	13808	29982	43790
1976	0	0	38634	0	38634
1977	0	0	19633	76513	96146
1978	0	0	34514	135166	169680
1979	0	0	41536	10941	52477
1980	16963	0	18517	44814	80294
1981	22437	0	117085	210598	350120
1982	67324	77918	160242	421246	726730
1983	475898	46500	71468	4794	598660
1984	218324	252769	37040	4072	512205
1985	268975	247322	2192	0	518489
1986	219323	361153	8755	0	589231
1987	318849	375872	3704	0	698425
1988	276050	473430	0	48	749528
1989	413318	384068	0	450	797836
1990	851532	665173	0	2152	1518857
1991	738313	363427	0	1776	1103516
1992	659536	288664	0	12576	960776
1993	375368	206522	0	6343	588233
	4922210	3742818	938332	1147262	10750622

USFS, Daniel Twardus

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APHIS
Swath widths

AIRCRAFT CATEGORIES

Aircraft Categories have been established to facilitate program planning for desired aircraft based on the insect life cycle, timing of application, support personnel, adequate airport space, required aircraft performance, length and strength of runways, taxiways and ramps, and the elevation and type of terrain to be treated.

The chart below lists aircraft by category, the assigned swath spacing for Malathion/oil and water mixtures, and the spray tip size required for the pesticide used. See Section II, I (electronic guidance) for information on swath spacing when electronic guidance is used.

AIRCRAFT	MALATHION, SEVIN 4-OIL AND ALL OIL MIXTURES	ALL WATER MIXTURES	STAINLESS STEEL FLAT FAN NOZZLE TIP REQUIRED		
CATEGORY A - FIXED WING					
	FEET	FEET	8 oz/A MALATHION	20 oz/A SEVIN 4-OIL	32 oz/A ORTHENE
ouglas DC-4/DC-6	550	400	8010	8015	8020
irchild C-119	500	350	8010	8015	8020
ouglas DC-7B & 7C	650	500	8015	8020	8030
00-30 Hercules w/Adds Pack Spraying System)	800	650	8008	8010	8015
CATEGORY B - FIXED WING					
rtiss C-46	500	350	8010	8015	8020
ouglas DC-3/C-47	400	300	8008	8010	8015
ckheed PV-2	400	300	8010	8015	8020
rtin 404	500	350	8010	8015	8020
uglas B-26	400	300	8010	8015	8020
CATEGORY C - FIXED WING					
rbine Thrush	150	100	8004	8006	8008
rbine Air Tractor	150	100	8004	8006	8008
rbine Ag-Cat	150	100	8004	8006	8008
rush (800 hp)	150	100	8003	8004	8006
rush (1200 hp)	150	100	8004	8006	8008
g-Cat (800 hp)	150	100	8003	8004	8006
g-Cat (1200 hp)	150	100	8004	8006	8008
win Beech/C-45	150	100	8004	8006	8008
per Aztec PA-23 (500 hp)	150	100	8004	8006	8008
omader M-18	150	100	8004	8006	8008
CATEGORY D - FIXED WING					
ssna (all 188 Models)	100	75	8002	8003	8004
rush/Snow/Air Tractor	125	100	8002	8003	8004
g-Cat (A Models)	100	75	8002	8003	8004
g-Cat (B & C Models)	125	100	8002	8003	8004
per Brave	100	75	8002	8003	8004
per Pawnee (120-260 hp)	100	75	8002	8003	8004
arman (450-600 hp)	100	75	8002	8003	8004
eatherly	100	75	8002	8003	8004
ilance Eagle	100	75	8002	8003	8004
CATEGORY A - HELICOPTERS					
ell 204/205/212/214	150	120			
korsky S-58-T	150	120			
CATEGORY B - HELICOPTERS					
ell 204/205/212/214	150	120			
louette III	120	100			
CATEGORY C - HELICOPTERS					
louette II	100	75			
ell 206	100	75			
ughes 500	100	75			
iller Seloy	100	75			
ell Seloy	100	75			
CATEGORY D - HELICOPTERS					
ell 47	100	75			
iller 12E	100	75			

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To W. McCune	From T. Roland
Co.	Co.
Dept.	Phone #
Fax # 508 564 4378	Fax #

Iral Ragenovich

REPORT TO: NATIONAL STEERING COMMITTEE
GYPSY MOTH AND EASTERN DEFOLIATORS
August 31 - September 1, 1993

SUBMITTED BY: IRAL RAGENOVICH
R-6

No Asian gypsy moths were trapped during the 1992 trapping season; so all 1993 gypsy moth eradication projects were for the European strain of the gypsy moth. In Oregon, four sites totalling 450 acres were treated aerially, and 3 sites were treated with ground eqipment. In Washington 120 acres (17 sites) were treated from the ground for gypsy moth in 1993. All treatments used B.t. in multiple applications.

Both States consider early detection of introductions and subsequent delimiting trapping and eradication as their first line of defense against gypsy moth becoming established. In 1993, 15 -, 24,000 traps were placed in Oregon and 10-14,000 traps were placed in Washington. This includes the additional traps for intensive trapping near ports and throughout the 1992 Asian gypsy moth treatment areas. To date, a total of 54 moths have been trapped in Oregon (52 were in the Lake Oswego area) and, over 107 have been trapped in Washington. Trapping will continue through September. All moths will be sent to the lab in Delaware, OH for genomic DNA testing to determine whether they are European gypsy moth, Asian gypsy moth, or a hybrid of the two strains.

Non-target Lepidoptera
During the environmental analysis for potential wsbw suppression projects, several issues came up that will probably be of future concern for any aerial application project. These included:

- -impacts of B.t. applications on non-target lepidopteran populations
- -species and abundance of non-target lepidopteran
- -subsequent effects of the reduction of the primary food source (the lepidopteran population) of the Townsend's big eared bat
- -the requirement by wildlife biologists to leave up to 1500' buffer strips along all riparian areas to prevent any possible drift into the riparian areas that may in some way effect the lepidopteran populations in this areas.

Region 6 funded 2 studies in conjunction with the 1993 wsbw suppression project to answer some of these questions. Both studies were to identify the species of lepidoptera and abundance occurring both within and outside of the treatment area, from May thru October. Studies will continue for two years following treatment to determine recovery rates of populations.

MESSAGE DISPLAY FOR JACK BARRY

To j.barry:r05h

From: Iral R. Ragenovich:R6/PNW Host: R06C
Postmark: Sep 02,93 3:07 PM Delivered: Sep 02,93 3:04 PM

Subject: Forwarded: Reply to a reply: AGM in Canada

Comments:
From: Iral R. Ragenovich:R6/PNW
Date: Sep 02,93 3:07 PM
more on dna testing and plans

Previous comments:
From: Max Ollieu:R6/PNW
Date: Sep 02,93 1:44 PM
THANKS TOM. IF APHIS CAN'T DO ALL THE DNA ANALYSIS, WE WILL NEED TO PROVIDE SAMPLES REPRESENTATIVE OF THE VARIOUS CATCHES. WILL LEAVE THE DETAILS TO IRAL AND DAVE.
MAX O.

Message:
From: THOMAS HOFACKER:WO
Date: Sep 02,93 4:08 PM
We discussed several actions yesterday including review of the present national survey plan and and commercialization of the DNA analysis or some other way that nuclear DNA analysis could be quickly done. The FS is transferring DNA analysis machinery to Otis so that APHIS can do DNA analysis. BUT this is difficult and time consuming and not sure how many they will be able to run.

From: Max Ollieu:R6/PNW
Date: Sep 02,93 1:02 PM
TOM - PLEASED TO HEAR THAT THE MILITARY IS BEING RESPONSIVE. FOR THOSE OF US NOT IN GENERALLY INFESTED GM AREAS, THE TRAPPING PROGRAM BECOMES EVEN MORE IMPORTANT. WE AND APHIS NEED TO STRESS WITH THE STATES THE IMPORTANCE OF RUNNING A FIRST CLASS OPERATION. SINCE OUR LEAD TIME IS GONE WITH AGMX, THE NEED FOR DNA ANALYSIS PROBABLY OUGHT TO BE SOP FROM NOW ON FOR ANY GM TRAPPED OUTSIDE THE GENEALLY INFESTED AREAS. DO YOU CONCUR & ARE YOU/WILL YOU TAKE THE LEAD WITH APHIS IN GETTING THE WORD OUT AND SUPPORT THE EXTRA DNA ANALYSIS? GUESS I AGREE WITH THE NEW ZEALANDERS IN THINKING WE ARE IN A DIFFERENT BALL GAME.
MAX O.

From: THOMAS HOFACKER:WO
Date: Sep 02,93 2:27 PM
The military has taken very aggressive action to inspect cargo coming from Germany to the US. The problem, as I see it, is with all the

-------========X========-------

MESSAGE SCAN FOR JACK BARRY

To j.barry:r05h

From: Iral R. Ragenovich:R6/PNW Host: R06C
Postmark: Sep 02,93 2:58 PM Delivered: Sep 02,93 2:55 PM

Subject: gmsteeringcommittee

Comments:
r6's summary for the report, per request. let me know if you need additional info. ~~iral~~

-------========X========-------

MESSAGE DISPLAY FOR JACK BARRY

To Max Ollieu
CC D.BRIDGWATER
CC J.BARRY:R05H
CC T.HOFACKER:W01C

From: Iral R. Ragenovich:R6/PNW Host: R06C
Postmark: Sep 02,93 1:05 PM Delivered: Sep 02,93 1:03 PM

Subject: Reply to a reply: AGM in Canada

Reply text:
From: Iral R. Ragenovich:R6/PNW
Date: Sep 02,93 1:05 PM
SPECIFICALLY, WE NEED GENOMIC DNA. APHIS DOES MITOCHONDRIAL DNA BUT THAT WILL NOT NECESSARILY PICK UP THE AGMX

Preceding message:
From: Max Ollieu:R6/PNW
Date: Sep 02,93 1:02 PM
TOM - PLEASED TO HEAR THAT THE MILITARY IS BEING RESPONSIVE. FOR THOSE OF US NOT IN GENERALLY INFESTED GM AREAS, THE TRAPPING PROGRAM BECOMES EVEN MORE IMPORTANT. WE AND APHIS NEED TO STRESS WITH THE STATES THE IMPORTANCE OF RUNNING A FIRST CLASS OPERATION. SINCE OUR LEAD TIME IS GONE WITH AGMX, THE NEED FOR DNA ANALYSIS PROBABLY OUGHT TO BE SOP FROM NOW ON FOR ANY GM TRAPPED OUTSIDE THE GENEALLY INFESTED AREAS. DO YOU CONCUR & ARE YOU/WILL YOU TAKE THE LEAD WITH APHIS IN GETTING THE WORD OUT AND SUPPORT THE EXTRA DNA ANALYSIS? GUESS I AGREE WITH THE NEW ZEALANDERS IN THINKING WE ARE IN A DIFFERENT BALL GAME.
MAX O.

From: THOMAS HOFACKER:WO
Date: Sep 02,93 2:27 PM
The military has taken very aggressive action to inspect cargo coming from Germany to the US. The problem, as I see it, is with all the stuff that was already shipped here before our trip to Germany (this year and last). No plans to try & track people & stuff down. I believe the feeling is that there has been too much come in for this.

From: Max Ollieu:R6/PNW
Date: Sep 02,93 11:12 AM
TOM - APPEARS YOUR INFO WAS RIGHT ON. NOT GOOD NEWS TO EITHER THE CANADIANS OR US. HOW MUCH EFFORT WILL WE (U.S.) PUT INTO BEING AWARE OF THESE POSSIBLE AGMX CONTAMINATED SHIPMENTS FROM GERMANY? AT A MINIMUM, THE ARMED FORCES PEST MGT. BOARD SHOULD BE MADE AWARE OF THE

-------========X========-------

MESSAGE DISPLAY FOR JACK BARRY

To Max Ollieu
CC D.BRIDGWATER
CC J.BARRY:R05H

From: Iral R. Ragenovich:R6/PNW Host: R06C
Postmark: Sep 02,93 12:29 PM Delivered: Sep 02,93 12:26 PM

Subject: Reply to a reply: AGM in Canada

Reply text:
From: Iral R. Ragenovich:R6/PNW
Date: Sep 02,93 12:29 PM
THIS WAS MENTIONED AT THE GM STEERING COMMITTEE IN SLC ALTHOUGH AT THE TIME WE DID NOT KNOW THE EXTENT. THIS IS OF CONCERN ESP. WITH THE REDUCTION IN MILITARY FORCES. I THINK APHIS AND CANADA HAVE SENT FOLKS OVER THERE AND ARE INVOLVED. THERE APPARENTLY ARE ALOS RAGING OUTBREAK IN ROMAINIA AND CHEZOSOLAKIA AS WELL ('SCUSE MY SPELLING).

Preceding message:
From: Max Ollieu:R6/PNW
Date: Sep 02,93 11:12 AM
TOM - APPEARS YOUR INFO WAS RIGHT ON. NOT GOOD NEWS TO EITHER THE CANADIANS OR US. HOW MUCH EFFORT WILL WE (U.S.) PUT INTO BEING AWARE OF THESE POSSIBLE AGMX CONTAMINATED SHIPMENTS FROM GERMANY? AT A MINIMUM, THE ARMED FORCES PEST MGT. BOARD SHOULD BE MADE AWARE OF THE SITUATION. SEEMS THAT SHIPMENTS TO THE STATES SHOULD BE TRACKED AND EXAMINED BEFORE ANY FURTHER ESCAPE. IS THERE ANY COORDINATION BETWEEN THE AFPMB AND APHIS, OR ARE WE INVOLVED IN ANY WAY? SEEMS THAT IN THIS CASE, IF THE STATES KNEW WHERE THE SHIPMENTS WERE DESTINED, THEY WOULD GET INVOLVED AS WELL. I WOULD THINK THAT WOULD BE THE CASE WITH EITHER WASHINGTON OR OREGON. MAX O.

From: THOMAS HOFACKER:WO
Date: Sep 02,93 1:43 PM
Max - We had a meeting yesterday & the Canadians participated via phone. Here's a short update: They found egg masses on containers in the Port of Karlsrue in Germany; containers go up the Rhine from there. In Canada itself they found egg masses on 8 containers that came out of Karlsrue. They also found egg masses & pupae on personal effects, bicycles and outdoor household goods that returning military

-------========X========-------

Dick Reardon

United States Department of Agriculture | Forest Service | Northeastern Area State & Private | 180 Canfield Street Morgantown, WV 26505

Reply To: 1580

Date: August 18, 1993

Subject: NEFAAT/AIPM/National Center of Forest Health Management Cooperative Projects - 1993

To: Jack Barry, Chairman
National Steering Committee for Management of Gypsy Moth and Eastern Defoliators

A series of technology development needs were identified at the National Steering Committee for Managing Gypsy Moth and Eastern Defoliators meeting held in Albuquerque, NM on August 18-19, 1992. I could not attend that meeting, but attempted to address several of the priorities through cooperative efforts in FY93. Here is a brief summary of field projects:

National Needs

Priority 1 - Bt non-target studies

- Impact of aerially applied Bt for gypsy moth control on non-target canopy Lepidoptera as relates to food of the Virginia Big-eared Bat -- completed data analysis of 3 year evaluation (1990-92)
  - cooperators - Butler/Sample, West Virginia University
    - detectable impacts on few species of larval and adult non-target canopy Lepidoptera but no detectable impact on Big-eared Bat populations
    - 2 publications
      - U.S. Forest Service - Northeastern Area NA-TP-10-93 Evaluation of Bt and Defoliation Effects on Native Lepidoptera by Sample, Butler, Zivkovich and Whitmore
      - manuscript submitted to Entomological Science
  - funded by AIPM Gypsy Moth Project
- Impact of aerially applied Bt on canopy and understory Lepidoptera in oak-hickory type in VA -- completed final year of 3 year evaluation
  - cooperators - Talley/Peacock, Rockbridge Co., VA and Northeast Forest Experiment Station (NEFES)
    - data being analyzed at NEFES - preliminary analysis indicates impact on understory and overstory macrolepidoptera

- publications in preparation

- funded by AIPM Gypsy Moth Project and NEFES

- initial year of potential 6-8 year evaluation: Technical Review Team evaluated 13 pre-proposals for long-term (>5 year) effort to determine regional impact of aerial application of Bt and gypsy moth defoliation on selected canopy arthropods, parasites and invertebrate predators, aquatic Lepidoptera and passerine birds. The "best" pre-proposal selected and principal investigator(s) will meet with State Cooperators prior to developing a plan of work. Field activities to begin in FY94.

Priority 3 - Improve methodology for monitoring, detecting and predicting low/high density gypsy moth populations

- published NA-TP-07-92 Sequential sampling plans for estimating gypsy moth egg mass density by Fleischer et al

  - funded by AIPM Gypsy Moth Project

- 5 years of AIPM male moth and egg mass data (13 million acres) being analyzed to evaluate the use of pheromone traps on various grids (100 m - 3 km) and sequential surveys for egg masses. Completed by December 15, 1993.

  - cooperators - Liebhold/Ravlin, NEFES and VPI&SU
  - funded by AIPM Gypsy Moth Project

- Fungus to control gypsy moth

  - completed final year of 3 year evaluations:

    - coop 42-607 Introduction and spread of E. maimaiga in the Appalachians - Ann Hajek (Boyce Thompson Institute)

    - coop 42-655 Competition between NPV and E. maimaiga - Joe Elkinton (Univ. of MA)

  - funded by AIPM Gypsy Moth Project

  - initial year of potential 3 year evaluation

    - Dr. Barry Hunter (California University of Pennsylvania) to process gypsy moth cadavers killed by E. maimaiga. Isolate spores from cadavers and conduct laboratory evaluations to determine modes of infection.

      - funded by AIPM Gypsy Moth Project and NA-FHP

Priority 5 - Mass balance of pesticides

- Diflubenzuron (Dimilin)

  - completed final year of 2 year evaluation:

- Fernow Experimental Forest, WV -- Dimilin residue levels foliage, litter, soil, water and artificial collectors

- 2 manuscripts submitted/accepted for publication Wimmer, West Virginia University

- Persistence of Dimilin on Appalachian Forest Leaves in Stream Water, J. Agric. and Food chemistry

- Persistence of Dimilin on Appalachian Forest Leaves after Aerial Application, J. Agric. and Food Chemistry

- funded by AIPM Gypsy Moth Project

- completed final year of 2 year evaluation:

- Black Moshanon, PA -- Dimilin residue levels, foliage, litter, and artificial collectors

- 2 manuscripts in preparation -- Prendergast, Penn State University

- funded by AIPM Gypsy Moth Project, NEFAAT, NAPIAP and NEFES

- Bt

- completed first year of 3 year evaluation

- Black Moshanon, PA -- use of Lidar to track Bt spray cloud

- cooperators - Mierzejewski (PSU), Miller (U of CT), NEFAAT

- funded by AIPM Gypsy Moth Project, NEFES and WO-FPM

Issues and Other Needs

1. Gypchek -- WO-FPM provides funding to APHIS/FIDR Hamden to produce @ 10,000 AE/year

-- American Cyanamid production of gypsy moth virus on-going Sault Ste Marie, CANADA

3. Silviculture -- 1st year post-implementation of silvicultural prescriptions for gypsy moth on George Washington National Forest. Gypsy moth populations low (only detect male moths) and building.

5. Bt undiluted formulations -- Karl Mierzejewski at Penn State and Dave Miller

at Univ. of Connecticut completed preliminary evaluations of evaporation rates

Additional Efforts

Biorationals

- Microbials
  - Gypchek
    - second year of 4 year evaluation: ready-to use formulations, various doses and rates in Michigan, Maryland and West Virginia
      - cooperators: Podgwaite (FS), Webb (ARS), American Cyanamid, Entotech, Reardon/Onken (National Center)
      - funded NEFES, ARS, National Center of Forest Health Management
  - Fungus - Entomophaga maimaiga
    - second and final year of laboratory non-target evaluations
      - cooperators: Hajek (Boyce Thompson) and Butler (West Virginia University)
      - funded National Center of Forest Health Management
- Semiochemicals
  - antiaggregation
    - first year of 2 year evaluation: novel host compound to protect red cockaded woodpecker cavity trees from southern pine beetle
      - cooperators: Drummond (R-8 FPM), Hayes (SFES)
      - funded by National Center of Forest Health Management
  - sex pheromones
    - Disrupt II (flake) dose response and formulation evaluations
    - AgriSense (beads) has submitted package to EPA to register their bead containing racemic disparlure
    - Shin-Etzu has provided a "chip" containing racemic disparlure for release rate and persistence evaluations
      - cooperators: Gypsy Moth Mating Disruption Working Group Leonhardt (ARS), McLane/Mastro (APHIS), Leonard (R-8 FPM) et al
      - funded by National Center of Forest Health Management

APPENDIX

SUMMARY OF COOPERATIVE AGREEMENTS (AS RELATE TO EASTERN STEERING COMMITTEE) FUNDED BY AIPM (1989-1992)/NATIONAL CENTER OF FOREST HEALTH MANAGEMENT (1993)

Non-targets

- Bt
  - coop 42-594 Sample/Butler - WVU
    Bt impact on Lepidoptera as food for Virginia Big-eared Bat total $220,000. for 3 years
  - coops 42-660 and 42-712 Talley/Peacock - Rockbridge Co., VA/NEFES
    Bt impact on canopy/understory Lepidoptera in VA total $120,000. for 3 years
- Dimilin
  - numerous coops and investigators. Dimilin impact on selected vert/invert within closed broadleaved watersheds total $1 million for 5 years
  - coop 42-664 Rebach - Univ. of Maryland - Dimilin impact on blue crabs total $42,000. for 2 years
- E. maimaiga
  - coop 42-688 Hajek - Boyce Thompson Inst. - Impact on Lepidoptera from WV and VA (Lab) total $32,000. for 2 years
  - coop 42-687 Butler - West Virginia University - Impact on Lepidoptera from WV and VA (Lab) total $32,000. for 2 years

Biorationals

- semiochemicals
  - sex pheromone (Gypsy Moth) for mating disruption
    - funded through coops, IRT's to R-8 - total @ $225,000. over 5 years

- microbials
  - Bt
    - funded in cooperation with NEFAAT, FIDR, APHIS, FS - field trials total @ $175,000. over 4 years
  - Gypchek
    - funded in cooperation with NEFES, APHIS, FS - field trials - total $250,000. over 5 years
  - E. maimaiga
    - coops 42-607 and 42-655 Hajek (Boyce Thompson Inst.) and Elkinton (Univ. of MA) - total @ $155,000. over 3 years

Aerial Application Technology

- spray models, meteorology, swath kit, Dimilin accountability, Bt drift
  - Penn State - Yendol, Mierzejewski et al - total $500,000. over 5 years
  - Univ. of CT - Dave Miller et al - total @ $150,000. over 5 years

United States Department of Agriculture | Forest Service | NA

Reply to: 1350 **Date:** August 19, 1993

Subject: FY93 Report of Non-target Impact Subcommittee

To: Jack Barry
Chairman, Eastern and Western Defoliator Nat'l Steering Committees

Overview

FY91 -- At the 1991 meeting (September 10-11, Blacksburg, VA) of the National Steering Committee for Managing Gypsy Moth and Eastern Defoliators, three subcommittees were formed: Pilot Training, Non-target Impact, and Canopy Characterization. In a letter (September 17, 1991) you requested that I chair the Non-target Impact subcommittee and include as subcommittee members: Leo Cadogan, FPMI/Canada and Steve Munson, R-4/FPM. In a follow up letter (March 10, 1992) you suggested two additional members: Dave Grimble, R-6/PNW and Dayle Bennett, R-3/FPM, and identified the charge of the subcommittee: to identify what is known and data gaps about the impacts of Bt and diflubenzuron (dimilin) on non-target Lepidoptera, aquatics, birds, and small mammals, and to submit a bibliography and recommendations to the steering committee at the 1992 meeting.

FY92 -- I was unable to attend the 1992 meeting (August 18-19, Albuquerque, NM) of the National Steering Committee for Managing Gypsy Moth and Eastern Defoliators but submitted a letter to you concerning progress by the Non-target Impact subcommittee. As a brief summary of that letter: Leo and I met at FPMI in April 1992 and discussed the need to identify scientists from the U.S. and Canada who would be interested in or were conducting non-target impact studies in forest ecosystems. In July 1992, Leo identified a preliminary group of scientists (list A) which was updated by Steve Holmes (list B). Leo and I intended to select a core group of scientists from list B and meet with them at the Pest Control Forum in Ottawa (November 1992).

Also, initial versions of Dimilin and Bt bibliography databases were developed through the efforts of Munson in association with the University of Utah and Amy Onken (Forest Health Protection, Morgantown) in conjunction with West Virginia University (see attachment). At that time, the databases contained about 700 and 900 citations concerning efficacy and non-target impacts, respectively.

Following the 1992 meetings of the Eastern and Western Defoliator Committees, Steve Munson sent a letter to me stating that 3 additional western representatives (Bruce Hostetler, R-6/FPM; John Wenz, R-5/FPM; and Larry Stipe, R-1/FPM) were selected to participate on the Non-target Impact subcommittee to help identify needs in the West. Steve Munson and I had the impression that these western representativies were added to the original Non-target Impact subcommittee but, in fact, you had intended Steve to chair another subcommittee "Impact of Biological Insecticides on Non-target Organisms" for the Western Defoliator Steering Committee.

In September 1992, I formed a technical review team composed of mostly eastern scientists (list C) to begin to develop guidelines and protocols for a proposed long-term evaluation of regional impacts of Bt and gypsy moth defoliation on selected non-targets in the East. This long-term regional project was proposed in response to data gaps identified during preparation of the EIS for the Appalachian Gypsy Moth Project (AIPM Project) and follow-up meetings with a coalition of environmental groups from Virginia and West Virginia.

FY93 Activities

Both bibliography databases were expanded and now contain approximately 950 and 1,500 citations, respectively. The databases are stored on disk and we are in the process of obtaining a reprint of each citation. The Dimilin database is nearing completion, whereas the Bt database can be expanded to include additional efficacy citations. There are no citations concerning human toxicology in either database.

Leo contacted most of the Canadian scientists from list B and identified a core group of scientists as members of the Non-target Impact subcommittee: Jan Volney, Imre Otvos, Steve Holmes and Kevin Barber.

To the best of our (Munson, Reardon, Cadogan) knowledge, the following is a list of non-target field evaluations involving the aerial application of Bt or Dimilin in forest ecosystems:

United States

East

Bt

* Impact of Bt on canopy and understory Lepidoptera associated with gypsy moth populations in oak-hickory forest in southern Virginia -- Talley/Peacock(Rockbridge CO., VA/NEFES) -- 3rd. year of 3-year effort.

Dimilin

* Impact of Dimilin on selected vert/invert. in closed broadleaved watersheds - conducted in West Virginia -- numerous investigators -- 5th. year of 5-year effort.

West

Bt

- Barry/Whaley/Anhold - Bt-drift/dispersion and effects on non-target Lepidoptera, Utah 1993 Phase III -- 3rd year of 4 -year effort

- Grimble - Impacts of Bt sprays on non-target Lepidoptera in mixed coniferous forests of eastern Oregon -- 2nd year of 3-year effort (NAPIAP funded)

- - Miller/Grimble - Impacts of Bt on non-target Lepidoptera on the Warm Springs Indian Reservation (Oregon) -- 1st year of 2-year effort

- Miller/Lighthart - Effects of large scale use of Bt var. kurstaki on non-target larval Lepidoptera: Cove Junction (Oregon) -- 2nd year of 2-year effort

General Survey

- Miller/Grimble - Survey of resident Lepidoptera populations across the central Cascades as a possible food source for Townsend's big eared bat -- 1st of 2-year effort

- Kephart (Willimette University)

  - Investigations and literature survey of Region 6 sensitive plant species and potential Lepidoptera pollinators

- Bennett - Survey to determine effects of Bt on non-target moths: Carson National Forest (New Mexico) -- 1st of 3-year effort (WSB population collapsed)

Canada

- Volney - Potential impacts of operational Bt spray on Lepidoptera -- conducted in Saskatchewan -- ? year effort

- Kreutzweiser - Effects of Btk on aquatic microbial activity, detrital decomposition and invertebrate communities -- conducted in Ontario -- 2nd year of 2-year effort

There are several issues which need to be resolved in FY93:

1. The establishment of one or two Non-target Impact subcommittees. We (Munson, Cadogan, and Reardon) propose one Non-target Impact Subcommittee could represent both the Western and Eastern Defoliator National Steering Committees. Reardon would be the chairman of the subcommittee in FY94 in an effort to coordinate this subcommittee's activities with those of the National Center of Forest Health Management. The National Center was created in April 1993 with three major areas of work emphasis: non-target impacts, biological controls, and biorationals. The purpose of the National Center is to accelerate development and applications of environmentally acceptable new technologies to maintain and improve the health of America's trees and forests.

2. Updating (additional/fewer) members on the Non-target Impact Subcommittee . The suggested members and chairman for each region:

West/US

Steve Munson, John Anhold, Chairman
Dave Grimble, R-6/PNW
Dayle Bennett, R-3/FPM
Bruce Hostetler, R-6/RPM
John Wenz, R-6/FPM
Larry Stipe/Nancy Campbell, R-1/FPM

East/US

Richard Reardon, Chairman
John Omer, NA/FHP
John Peacock, NEFES
Sandy Liebhold, NEFES
Jeff Witcosky, R-8/FPM

Canada

Leo Cadogan, Chairman
Jan Volney, For. Can. N. Alts
Imre Otvos, For. Can, Pac & Yu
Steve Holmes, For. Can. FPMI
Kevin Barber, For. Can. FPMI

3. The need for the Non-target Impact Subcommittee to focus its activities on microbial insecticides used to manage defoliators in forest ecosystems. Specifically, the immediate emphasis areas in the West/US is on Btk and in the East/US is on Btk and Entomophaga maimaiga.

4. Identify the objectives of the Non-target Impact Subcommittee .

FY94 Activities

1. Initiate and complete 5-year plan of work which identifies regional priorities (e.g. data gaps) and contains baseline protocols/procedures for conducting non-target evaluations.

2. Publish and continue to update the Dimilin and Bt bibliography databases.

3. Focus efforts on Bacillus thuringiensis kurstaki:

   a. general surveys to obtain baseline data on populations of Lepidoptera (terrestrial and aquatic) for specific ecosystems

b. potential impacts on selected non-targets (e.g. indicator species, T/E species)

- one comparable study established in Western United States, Eastern United States, and Canada.

4. Identify and solicit input from amateur lepidopterists in developing the 5-year plan of work as well as for individual evaluations.

Richard

RICHARD C. REARDON
Program Manager
National Center of Forest Health Management

cc: Munson
Cadogen

(A)

Memo to: Steve Holmes
From: Leo Cadogan
Subject: Formation of a working group relating to the study of the effects of Bt on non target organisms.

As promised at our meeting with Dr. R. Reardon on 22/4/92 I contacted a number of people and the following have been identified as either working in the general areas or are interested in participating in such a working group.

Bill Ernst	CWS	Impact on stream invertebrates
Neil Burgess	CWS	Impact on Birds and/or amphibians
Guy Sirois	CWS Moncton	Impact on Fish
Wendy Sexmith	NB Environ	Funding, Regulatory Affairs
Nelson Carter	NB DNR	Funding and Participation
Jim Bendell	U of T Forestry	Impact of Grouse & Small Mammals
Brian Naylar	OMNR Tech Dev. Unit N Bay	Small Mammals
Candid Czuba	" "	"
Ross D. James	ROM	Song Birds
M.I. Bellocq	U of T Forestry	Small Vertebrates
Jan Volney	ForCan Northern Alta	Gen Bt studies in the Prairies
Imre Otvos	ForCan Pac & Yukon	Gen Bt studies on the West Coast

You can forward this list to Dick Reardon with your additions.

LCO

B.L. Cadogan

22/7/92.

Forestry Canada Forêts Canada

(B)

4 September 1992

Dr. Richard Reardon
AIPM Project Leader
USDA Forest Service
180 Canfield St.
Morgantown, West Virginia, USA
26505

Subject: Formation of a working group - Effects of B.t. on non-target organisms

Dear Richard,

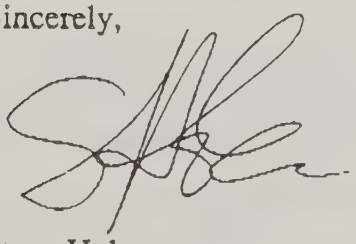
Leo Cadogan has provided me with a list of Canadian researchers who may be interested in participating in a working group on the effects of B.t. on non-target organisms. I have added a couple of names and am passing the complete list on to you.

Bill Ernst	Environment Canada, Halifax	stream invertebrates
Guy Sirois	Fisheries and Oceans Canada, Moncton	fish
Neil Burgess	Canadian Wildlife Service, Sackville	birds, amphibians
Pierre Mineau	Canadian Wildlife Service, Hull	birds, amphibians
Bruce Pauli	Canadian Wildlife Service, Hull	birds, amphibians
Dan Welsh	Canadian Wildlife Service, Ottawa	birds
Jan Volney	Forestry Canada, Northwest Region	general interest
Imre Otvos	Forestry Canada, Pacific & Yukon Region	general interest
Wendy Sexsmith	New Brunswick Department of the Environment, Fredericton	funding, regulatory affairs
Nelson Carter	New Brunswick Department of Natural Resources, Fredericton	funding, general interest
Pierre-Martin Marotte	Ministère de l'Énergie et des Ressources Charlesbourg	persistence, general interest
Ghislain Rousseau	Société de protection des forêts contre les insectes et maladies, Québec	general interest
Brian Naylar	Ontario Ministry of Natural Resources, North Bay	small mammals
Candid Czuba	Ontario Ministry of Natural Resources, North Bay	small mammals
Jim Bendell	University of Toronto	grouse, small mammals
M. Bellocq	University of Toronto	songbirds, small mammals
Ross James	Royal Ontario Museum	songbirds

Canada

I understand that you would like to try to get a group together at the time of the Forest Pest Control Forum in November. I think that this is an excellent idea. If you decide that you want to pursue it, let me know and I will make the necessary arrangements here (book a room, call potential Canadian participants, etc.). Hope to hear from you soon.

Sincerely,



Steve Holmes
Forestry Canada
Science and Sustainable Development
Place Vincent Massey, 21st Floor
351 St. Joseph Blvd
Hull, Quebec
K1A 1G5

Dimilin and Bacillus thuringiensis kurstaki Bibliographies

The National Center of Forest Health Management
Healthy Forests Make A World Of Difference
TechnologyTransfer

Dimilin and Bacillus thuringiensis kurstaki (Bt) bibliographies are installed and maintained in a computerized database, at the USDA Forest Service National Center of Forest Health Management in Morgantown, West Virginia. Anyone who needs information or data about Dimilin, Bt or both can search these bibliographies, using a Forest Service computerized retrieval program. These bibliographies contain references to efficacy and non-target data but not human toxicology.

The retrieval program allows the user to search for specific articles. A file search may be accessed several ways:

(1) Each field of the database can be searched for all articles that contain a certain value. For example, a search of the field "title" for the value "anni" would find any records that contain "anni" such as Tannins, tannin, or mannitol or the field "year" for 198_ would match records with the years from 1980 to 1989.

(2) To narrow the search, use more than one field. For example, searching the field "year" for "1986" and field "title "for "anni" will find all records for the year 1986 with "anni" in the title.

Any field may be searched for more than one value and any number of fields may be searched. When requesting records please include the fields to searched and the values to be found. Please narrow the search as much as possible.

The records may be printed as a bibliography citation (as for use in preparing a paper) which will not include the abstract, or printed including the abstract.

Searching the Bibliographic Database

The bibliographies have several different fields:

Name of Field	Type of Field and Width
Author	Character (240)
Year	Character (4)
Title	Character (240)
Source	Character (240)
ISSN (National Cataloging System)	Character (25)
NAL (National Agricultural Library)	Character (25)
Language	Character (80)
Abstract	Long

If you have any questions or would be interested in obtaining records from the Dimilin and Bt bibliographic databases, please contact:

Amy Onken
USDA Forest Service
National Center of Forest Health Management
180 Canfield Street
Morgantown, WV 26505
(304) 285-1565
DG Address: S24L08A

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304-285-1566
FAX 304-285-1505

Noel Schneeberger

MESSAGE DISPLAY FOR NOEL SCHNEEBERGER

To NOEL SCHNEEBERGER:S24A
To R.PYWELL:W04A
To JIM

From: JAMES B. HANSON:S23A
Postmark: Aug 24,93 12:56 PM Delivered: Aug 24,93 1:55 PM
Status: Previously read
Subject: Reply to: Technology Development needs

Reply text:
From: JAMES B. HANSON:S23A
Date: Aug 24,93 12:56 PM
YES. WE STILL HAVE A LOT OF DIFFICULTY GETTING ADEQUATE COVERAGE ON OUR SUPP/ ERADICATION PROJECTS. I WAS ON THE GROUND FOR THE WI PROJECT THIS SPRING AND OBSERVED SOME 50 FOOT SWATHS, 400 FT SWATHS, ETC. THE SWATH WIDTH WAS SUPPOSED TO BE 175 FEET. NO MATTER HOW PRECISE WE GET WITH DETERMINING SWATH WIDTHS ON THE GROUND, THE PILOT IS STILL ON HIS OWN WHEN HE GETS UP IN THE AIR (THIS ONE HAD LORAN C TOO). ESPECIALLY FOR ERADICATION, WE NEED TO HAVE GOOD COVERAGE AND NEED TO KNOW WHERE THE PILOT HAS SPRAYED. I HAVE THOUGHT ABOUT USING VIDEOGRAPHY TO RECORD THE PLANES SWATHS AND THEN THAT SAME DAY PLOT THE LINES ON THE SPRAY AREA MAP SO ANY SKIPS CAN BE RETREATED THE NEXT DAY. ANOTHER POSSIBILITY MAY INCLUDE EVALUATING SOME OF THE NEW GPS SYSTEMS THAT HAVE BEEN DEVELOPED FOR AIRPLANES. I WOULD APPRECIATE YOU BRINGING THIS UP TO THE COMMITTEE AND RANKING IT ONE OF THE TOP PRIORITIES FOR YOUR GROUP. WE SPEND SO MUCH MONEY ON THESE PROJECTS (ESP.ERADICATION) THAT WE NEED TO ENSURE THAT THE AREA HAS BEEN ADEQUATELY TREATED RATHER THAN RELYING ON 2 OR 3 SO- SO APPLICATIONS. WITH THE ASIAN AND ASIAN/ EUROPEAN STRAIN OF GM TO CONTEND WITH, IT BECOMES EVEN MORE IMPORTANT THAT WE HAVE GOOD SPRAY COVERAGE. THANKS FOR BRING THIS TO THE COMMITTE.

Preceding message:
From: NOEL SCHNEEBERGER:S24A
Date: Aug 24,93 1:31 PM
Any burning needs that I can take to Jack Barry's National Pesticide Steering Committee meeting next week in SLC? Gerry and I met with Pete Rush, Dick Reardon and four state cooperators last week about the status of dimilin and their needs. Several issues came forward

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NATIONAL STEERING COMMITTEE
GYPSY MOTH AND EASTERN DEFOLIATORS

Red Lion Inn
Salt Lake City, Utah
August 31-September 1, 1993

A REPORT FROM THE NORTHEASTERN AREA

I. Summary of 1993 Gypsy Moth Activities

Between 1988 and 1992 and average of 1 million acres has been treated annually on federal, state, and private lands in the generally infested area to suppress gypsy moth populations. This past year suppression acreage dropped to aproximately 582,000 acres in 9 states, 4 National Forests, and a number of other federal ownerships (Department of Defense, National Park Service, Fish and Wildlife Service, and Army Corps of Engineers). Bt was used on about 64 percent of the acreage treated and Dimilin on 35 percent. About 1 percent was treated using other materials such as Gypchek or phermone flakes. Most of the Bt was applied in undiluted form using a 48 BIU per gallon product. Rates ranged from 16 BIUs per acre to 36 BIUs per acre. Most projects used 24 BIUs per acre. Dimilin 4L was the dimilin formulation of choice by most project mangers although at least one state used some Dimilin 25W. Application rates were generally 0.5 ounces active ingredient per acre although some used as little as 0.25 ounces per acre with acceptable results.

Forest Service funded eradication projects were conducted on more than 41,000 acres in 5 states (Georgia, Tennessee, Utah, West Virginia, and Wisconsin). The largest, some 33,000 acres was conducted in Wisconsin. Most of the acreage was treated with Bt (undiluted).

Approximately 6000 acres were treated in North Carolina, Virginia, and West Virginia in the Slow the Spread (STS) piolot project. About half of that acreage was treated with Bt while the other half was treated with Gypchek or Phermone Flakes.

A summary of Forest Service funded suppression and eradication projects is shown in Table 1. Eradication projects sponsored by the Animal and Plant Health Inspection Service are summarized in Table 2.

Suppression and eradication project summaries from Delaware, Georgia, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, and West Virginia are presented with this report.

TABLE 1

GYPSY MOTH SUPPRESSION AND ERADICATION PROJECTS, 1993[1]

STATE	DIMILIN	BT	OTHER	TOTAL
COOPERATIVE				
Delaware	4255	14817	0	19072
Maryland	15696	25154	0	40850
Michigan	0	228400*	0	228400
North Carolina	0	360	0	360
New Jersey Ag	0	12309	0	12309
Ohio	2738	1700	0	4438
Pennsylvania	78857	29860	0	108717
Virginia	40035	21419	0	61454
West Virginia	58535	3090	0	61625
NATIONAL FOREST				
Huron-Manistee	0	2004	0	2004
Allegheny	0	16485*	0	16485
Geo. Washington	688	6130	25	6843
Monongahela	0	7281	2724*	10005
OTHER FEDERAL				
Blackwater NWR, MD	0	0	158*	158
C&O Canal, MD	0	0	85*	85
Eastern Neck NWR, MD	0	0	220*	220
Harpers Ferry NP, MD	0	430	0	430
National Capital Region-E, MD	0	150	0	150
Shenango River Lake, PA	0	33	0	33
Blue Ridge Parkway, VA	828	537	0	1365
Manassas NBF Park, VA	0	400	0	400
Prince William Forest, VA	0	296	308*	604
Quantico Marine Base, VA	3440	926	0	4366
Shenandoah NP, VA	1176	0	0	1176
Harpers Ferry NP, WV	0	150	0	150
ERADICATION				
White County, GA	0	1937*	0	1937
Wash. & Sequatch. County, TN	0	840*	155*	995
Uinta NF, UT	0	966**	0	966
Wasatch Front, UT	0	2415**	0	2415
Wasatch-Cache NF, UT	0	1755	0	1755
Wisconsin	0	32870	0	32870
WVDA Regulatory	120	0	0	120
SLOW-THE-SPREAD				
White's Fork, NC	0	3200*	0	3200
Jefferson NF	0	0	2248	2248
Virginia S&PF Lands	0	0	338	338
West Virginia S&PF Lands	0	0	237	237
TOTAL	206368	415914	6498	628780

*Double applications on some or all of these acres.
**Triple applications on some or all of these acres.

Revised July 13, 1993.

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[1]Forest Service-funded projects.

II. Technology Development Needs

NA Forest Health Protection sponsored its annual review of suppression and eradication projects on July 19-21 in Berkeley Springs, WV. The purpose of the meeting is to discuss the projects and to identify problems common to all cooperators as well as technology needs. A followup meeting was held in Morgantown WV on August 17 with a group of state cooperators who use Dimilin in their projects. There was a great concern on their part that Dimilin was being phased out of the cooperative projects. In the process of that meeting the states identified technology development needs that they would like to see the Forest Service pursue. The top two are:

1. Determine the lowest application rate of Dimilin (a.i./acre) that is effective in achieving suppression objectives.

2. Determine the lowest volume of Dimilin that can be applied that is effective in achieving suppression objectives.

There were several other items that also need to be addressed in the future. These include:

- Begin evaluating the new insect growth regulator by Rohm and Haas
- Continue work on determining and recommending effective swath widths
- Identify and evaluate navigation systems that will improve consistent lane separation across the treatment area.

Prepared by: Noel F. Schneeberger

TABLE 2

GYPSY MOTH ERADICATION PROJECTS, 1993[2]

STATE	TREATMENT	APPROXIMATE ACRES[3]
ARKANSAS		
Newton County	Dimilin-aerial and Mass Trapping	23,600
ILLINOIS		
Cook, Lake, and McHenry Counties	Bt-aerial and Mass Trapping	671
INDIANA		
Noble County	Mass Trapping	7
IOWA		
Butler, Cerro Gordo, Franklin, Hancock, Polk, and Worth Counties	Bt -aerial and ground	75
NORTH CAROLINA		
Pender, Sampson, Carteret, and Ashe Counties	Bt-ground and Dimilin-ground	17
OHIO		
Hamilton and Williams Counties	Mass Trapping	130
OREGON		
Benton, Multnomah, and Clackamas Counties	Bt-aerial and ground	451
SOUTH DAKOTA[4]		
Pennington County	Mass Trapping	25,000
WASHINGTON		
Clark, King, Kitsap, Lewis, Pierce, Stevens, and Thurston Counties	Bt-ground	120
WEST VIRGINIA		
Jackson County	Mass Trapping	16
WISCONSIN		
Dane, Jefferson, Waukesha, Brown, Milwaukee, Door, Fond Du Lac, Sheyoygan, Kewaunee, and Manitowoc Counties	Bt-aerial and Mass Trapping	3,643

[2]APHIS-funded projects.

[3]Acreages are subject to change upon verification from APHIS.

[4]Forest Service-funded project.

1993 SUPPRESSION AND ERADICATION STATE REPORTS

Delaware
Maryland
Georgia
Michigan
New Jersey
North Carolina
Ohio
Pennsylvania
Tennessee
West Virginia

STATE OF DELAWARE
DEPARTMENT OF AGRICULTURE
DIVISION OF PROMOTION & PRODUCTION SUPPORT
2320 SOUTH DUPONT HIGHWAY
DOVER, DELAWARE 19901
TELEPHONE: (302) 739 - 4811
FAX: (302) 697 - 6287

1993 DELAWARE STATE REPORT

Donald A. Eggen, Lynn Harrison, and Jeffrey Brothers
Delaware Department of Agriculture
Plant Industry Section
2320 South DuPont Highway
Dover, Delaware 19901
(302)739-4811

SPRAY PROGRAM

A total of 19,072 acres were treated in Delaware in 1993 at a total cost of $150,133.55. A total of 2,404 acres, residential developments, were treated twice with Foray® 48B. Application began on May 3 and was completed on May 10. Foliage expansion on the oaks ranged from 20 to 40% on May 3. Caterpillars were in the first and second instars. This year was the first full year under the new Local Coordinator program, where all privately owned lands surveyed and treated were on a request basis only. No cost-sharing was required due to sufficient federal and state funding.

Dimilin 4L was applied to 4,255 acres at the rate of one fluid ounce (0.5 oz AI) per acre in one gallon of water. One AG-Truck Cessna 188B from subcontractor Del Ag Aero was used to spray Dimilin at a cost of $5.93 per acre (includes insecticide and cost of application).

Dipel® 6AF was applied undiluted to 8,757 acres at the rate of 24 BIUs/64 oz/acre. One Dromader M18 with rotary atomizers from sub-contractor Tallman Aerial Spraying was used to spray Dipel® at a cost of $6.84 per acre.

Foray® 48B was applied undiluted to 3,656 acres of rural woodlots and state owned lands (single application) and to 2,404 acres of residential developments (double application) at the rate of 24 BIUs/64 oz/acre. One Bell 47 Soloy with rotary atomizers from contractor Helicopter Applicators, Inc. was used to spray Foray® at a cost of $7.68 per acre.

RESULTS

An aerial survey for defoliation was conducted by the Delaware Department of Agriculture in late June. Refer to the attached tables for the results. A total of 26,140 acres were defoliated this year, which is up from the 5,102 acres defoliated in 1992 and represents the largest number of acres ever defoliated in Delaware by the gypsy moth. However, because over half of the acres defoliated occurred in Sussex County, a substantial amount of the defoliation is due to the buck moth. The buck moth is in the fourth year of an outbreak in southern Sussex county.

Defoliation within spray blocks is up this year compared to previous years. However, we do not have final figures for the amount of defoliation that occurred within treatment blocks. We should have this information available for the Gypsy Moth Review meeting in November.

Every year since the mid-1980's Delaware has always been able to spray all qualified areas with egg mass densities exceeding 250 egg masses per acre. This year was the first full year of the Local Gypsy Moth Coordinator/Land Owner Cost-sharing Program. Landowners requested that a survey be conducted in their area. The cut-off date for this request was September 15. Only those private lands with a local coordinator, that agreed to coordinate a specific woodlot or residential development was surveyed along with state parks, state forest lands, and state wildlife areas. As a result many privately owned wooded areas in the state were not surveyed, and therefore not included in the aerial spraying program.

For 1994, coordinators must sign-up for fall surveys by September 15, 1993 by submitting a topographic map along with the name of the person who will be the coordinator. We will only survey state and county lands and those private lands that have a coordinator. We will hold a public meeting on August 25 to let new and previous coordinators sign-up for surveys, collect literature to hand out to their neighbors, and ask questions about the program. To date, we have 111 rural woodlot coordinators and over 75 residential developments interested in signing-up for the fall surveys.

COMMENTS

There was only one small problem this year during the spray program, when a bent axle on the insecticide mixing trailer for the helicopter resulted in a switch in support equipment during the program. No down time occurred, as the contractor provided a backup support truck overnight.

Both the helicopter and the Dromader used rotary atomizers to spray B.t. There were no seal problems until the very last load for the Dromader, which was spraying Dipel® 6AF. After each day of spraying, water was run through the tank and spray system to clean out any residue B.t. material. The Dromader had a separate tank to hold water, so the pilot did not have to land in order to rinse out his tank.

The revision to the Delaware Spraying Contract, with a well documented Table of Contents was greatly appreciated by all of the aerial spray contractors and bidders.

1993 DELAWARE GYPSY MOTH PROGRAM

FALL 1992 EGG MASS SURVEY SIGN-UP

Land Use	# of Blocks	Acreage
Coordinated Rural Woodlots	62	13,225
Coordinated Residential Developments	55	4,540
State & County Parks	7	1,860
State Wildlife Areas	5	6,170
State Forest Tracts	14	6,900
TOTALS	143	32,695

Summary of 1993 Qualifying Acreage in Delaware
for the Gypsy Moth Suppression Program.

Land Use Category	B.t. Proposed Acreage	DFB Proposed Acreage	Total Qualifying Acreage
Coordinated Rural Woodlots	6,726	4,210	10,936
Coordinated Residential Developments	2,404	0	2,404
Publicly Owned Lands	3,735	45	3,780
Non-coordinated Rural Woodlots Adjacent to Publicly Owned Lands	1,952	0	1,952
Total Qualifying Acreage	14,817	4,255	19,072

DELAWARE DEPARTMENT OF AGRICULTURE

1993 DELAWARE GYPSY MOTH DEFOLIATION				
	DEFOLIATED ACRES			
COUNTY	LIGHT <30%	MODERATE 30-60%	HEAVY >60%	TOTAL
New Castle	0	60	168	228
Kent	1,537	3,723	2,789	8,049
Sussex	1,281	13,313	3,269	17,863
State Total	2,818	17,096	6,226	**26,140**

DELAWARE DEPARTMENT OF AGRICULTURE

HISTORY OF THE DELAWARE GYPSY MOTH PROGRAM 1979 - 1993

YEAR	ACRES TREATED BT	ACRES TREATED DIMILIN	ACRES TREATED TOTAL	TREATED ACRES DEFOLIATED	TOTAL ACRES DEFOLIATED STATEWIDE
1979	0	0	0	0	10
1980	0	0	200[1]	0	0
1981	0	0	500[2]	NA	260
1982	355[3]	0	355	NA	1,425
1983	0	1,076	1,076	NA	2,992
1984	29,120	0	29,120	6,500	14,203
1985	58,427[4]	0	58,427	3,622	5,144
1986	42,071	16,722	58,793	1,569	3,118
1987	16,159	35,352	51,511	902	2,530
1988	13,098	30,297	43,395	97	791
1989	14,185	25,515	39,700	80	1,888
1990	15,256	42,462[5]	57,718	218	3,790
1991	6,219	35,353	41,572[6]	277	13,475
1992	19,375	17,280	36,655[7]	1,251	5,102
1993	14,817[8]	4,255	19,072	?	26,140

[1]Sevin 4-oil applied to 200 ac by Winterthur Gardens to their property
[2]Sevin 4-oil applied to 200 ac in Winterthur Gardens and 50 ac in Westover Hills by helicopter (privately sprayed); & approximately 250 ac using a ground mist applicator along Route 13 between Dover & St. Georges bridge (USDA/APHIS).
[3]Two applications made on 355 acres
[4]Two applications made on 8,800 acres
[5]Two applications made on 24 acres
[6]An additional 20,984 acres were not sprayed due to budget limitations
[7]An additional 4,827 acres were not sprayed due to budget limitations
[8]Two applications made on 2,404 acres

SUMMARY OF *B.t.* APPLICATIONS
for DELAWARE
1993

1. **ACRES TREATED:** 3656 ac (1X)
2404 ac (2X)

2. **FORMULATION:** Foray® 48B

3. **APPLICATION RATE (OZ/ACRE):** 64

4. **DOSAGE (BIUs/ACRE):** 24

5. **AIRCRAFT USED (List type, e.g. Bell 206):**

Bell 47 Soloy - Tail #N125CD - Dean Webb & Mike Page, pilots - Helicopter Applicators, Inc.
Cost = $7.68/acre (Insecticide cost was $4.68/ac & other costs were $3.00/ac).

6. **IN DETAIL, DESCRIBE THE SPRAY SYSTEM SETUP (Include number, type, model, position/orientation, etc. of nozzles/atomizers, and other pertinent information):**

6 Micronair AU7000 rotary atomizers, 35° blade angle, VRU = 7, PSI = 38, Flowrate = 6.1 gpm, Airspeed = 60 mph, Spray swath = 100 ft, Boom length = 35 ft

7. **IN DETAIL, DESCRIBE ANY PROBLEMS ENCOUNTERED AND HOW THEY WERE RESOLVED (Include problems with handling the *B.t.*, mixing it, or applying it; or problems with the spray system):**

No Problems. A rough estimate of the amount of Foray material going through the meters, which were calibrated with water, indicated a 2% shortfall (i.e. when the meter read 100 gallons, only 98 gallons had actually gone through the meter). Because the helicopter loads were usally between 50 and 100 gallons, the 2% shortfall was not considered to have any effect on the expected results. A few tenths of extra material was usually added to each load.

8. **GENERAL COMMENTS CONCERNING APPLICATIONS (Efficacy, field work still needed, other):**

Post treatment larval counts were conducted in all spray blocks. Larval surveys began on May 17, 1 week after the spray program was completed. Aerial defoliation surveys began on June 14 and were completed on June ??. Defoliation survey results within Foray® treated blocks are as follows:

?? of 31 single application blocks had some defoliation greater than 20%.
?? of 28 double application blocks had some defoliation greater than 20%.

BT Formulation	# of acres treated	# of acres defoliated 20-30%	# of acres defoliated 30-60%	# of acres defoliated 60-100%	# of treated acres defoliated
Foray® 48B (1X)	3656				
Foray® 48B (2X)	2404				
Total	6060				

9. **FOR MORE INFORMATION, CONTACT:**

NAME: Dr. Donald A. Eggen
AGENCY & ADDRESS: Delaware Department of Agriculture
Plant Industry Section
2320 South DuPont Hwy
Dover, DE 19901
TELEPHONE NUMBER: (302)739-4811 fax: (302)697-6287

SUMMARY OF *B.t.* APPLICATIONS

for DELAWARE

1993

1. **ACRES TREATED:** 8757 ac (1X)

2. **FORMULATION:** Dipel® 6AF

3. **APPLICATION RATE (OZ/ACRE):** 64

4. **DOSAGE (BIUs/ACRE):** 24

5. **AIRCRAFT USED (List type, e.g. Bell 206):**

Dromader M18 - Tail #N5198Y - John Tallman, pilot - Tallman Aerial Spraying
Cost = $6.84/acre (Insecticide cost was $4.68/ac & other costs were $2.16/ac).

6. **IN DETAIL, DESCRIBE THE SPRAY SYSTEM SETUP (Include number, type, model, position/orientation, etc. of nozzles/atomizers, and other pertinent information):**

10 Micronair AU5000 rotary atomizers, 55° blade angle, VRU = 11, PSI = 26, Flowrate = 18.18 gpm, Airspeed = 120 mph, Spray swath = 150 ft, Boom length = 43 ft

7. **IN DETAIL, DESCRIBE ANY PROBLEMS ENCOUNTERED AND HOW THEY WERE RESOLVED (Include problems with handling the *B.t.*, mixing it, or applying it; or problems with the spray system):**

No Problems. The Dromader had a separate holding tank for water, so at the end of the spray-day he could rinse his tank and pump system with water without having to land and load water to clean the aircraft's spray system. The plane was new and already had seals installed in the pump system. On the last spray load of the project, the seal gave out due to problems with Bt. The seal was replaced with a tungsten seal.

8. **GENERAL COMMENTS CONCERNING APPLICATIONS (Efficacy, field work still needed, other):**

Post treatment larval counts were conducted in all spray blocks. Larval surveys began on May 17, 1 week after the spray program was completed. Aerial defoliation surveys began on June 14 and were completed on June ??. Defoliation survey results within Dipel® treated blocks are as follows:
?? of 18 single application blocks had some defoliation greater than 20%.

BT Formulation	# of acres treated	# of acres defoliated 20-30%	# of acres defoliated 30-60%	# of acres defoliated 60-100%	# of treated acres defoliated
Dipel® 6AF (1X)	8757				

9. **FOR MORE INFORMATION, CONTACT:**

NAME: Dr. Donald A. Eggen
AGENCY & ADDRESS: Delaware Department of Agriculture
Plant Industry Section
2320 South DuPont Hwy
Dover, DE 19901
TELEPHONE NUMBER: (302)739-4811 fax: (302)697-6287

Maryland Department of Agriculture

Forest Pest Management Section

1993 Cooperative Suppression Project Report

The Maryland Department of Agriculture (MDA), Forest Pest Management (FPM) Section began the 1993 Suppression Year (SY 93) in the summer of 1992 with defoliation surveys. Summer surveys indicated defoliation due to gypsy moth declined state wide for a second year in a row (Table 1). Only 222 acres of the 84,174 acres treated in the 1992 suppression program experienced damaging leaf loss. This indicated an efficiency rating for the 1992 spray program of 99.7%. The 38,704 acres of trees defoliated was less than half the average total defoliation for the previous seven years, and the lowest total since 1983. The worst news was that the seven counties that constitute the Eastern Shore Region of the state suffered 37,303 acres or 96.4% of the total state defoliation. Other areas of the state reported dramatic reductions in defoliation. Entomophaga maimaiga, was confirmed in several counties and obviously contributed to the decline in populations in traditionally high population areas.

In Fiscal Year 1993 (FY 93), Maryland was suffering from the recession which was griping most of the country. Inasmuch, the state government experienced layoffs, cutbacks and the elimination of jobs and sections. Our Gypsy Moth Suppression Program was hit with a 30% reduction of funding. As the state trimmed it's budget, so did the counties.

1993 egg mass surveys indicated that most of the Eastern Shore counties would experience dense populations of gypsy moth caterpillars in the spring of 1993. Other areas of the state, with the exception of part of Southern Maryland were predicted to have mild gypsy moth populations.

Unfortunately, three of the seven Eastern Shore Counties decided not to participate in cost sharing for the 1993 spray season. One of these counties, Dorchester, did become involved with the Forest Resource Protection Initiative (FRPI) where landowners who have large tracts of managed forests that would not meet the state's priority spray block selection criteria could pay to protect their managed wooded properties. Other Eastern Shore Counties reduced or "capped" their proposed contribution to the cost share program. The final acre estimates for the 1993 spray program revealed that only 40,000 acres were to be proposed.

We initiated Invitations For Bid (IFB) for three contracts to spray approximately 40,000 acres in the 1993 season (compared to seven contracts for approximately 184,000 acres in 1990). Bids were awarded to K & K Aircraft for fixed wing operations (26,000) and Ag Rotors for rotary wing operations (14,000).

Maryland experienced a cool spring. We delayed spraying about a week to allow for proper insect development and foliage

expansion. Spray missions began on the Eastern Shore on May 6, on May 8 in Southern Maryland and on May 10 for the Central Region. The spray operations were conducted safely, effectively and efficiently. However, there were a couple of notable incidents which marred an otherwise good operation.

The Eastern Shore operation began with two single engine and one twin engine aircraft. The first day proved to be a test for our personnel and our Work and Safety Plan. After completing it's first load the twin Beech returned for another assignment. While filling the insecticide tank, a incident occurred spilling an unknown quantity of diluted Foray 48B on the tarmac. Mix crews and personnel reacted immediately by simultaneously withdrawing insecticide from the plane's tank and containing the spill with absorbent material. This operation was witnessed by Bob Adams, USDA Forest Service who was visiting Maryland to observe Gypsy Moth Spray operations. The spill was contained and removed efficiently and quickly. MDA personnel contacted the U.S. Environmental Protection Agency (EPA), the Maryland Department of Environment (MDE) and the Pesticide Regulation Section as prescribed in our 1993 Work and Safety Plan. Initially the spill was believed to be between 150 to 200 gallons of Foray 48B diluted 1:1. This number was reduced as cleanup operations continued. Mixing crew personnel along with MDA staff metered off the remaining insecticide from the twin Beech's tank. The pilot was questioned and all calculations were checked and rechecked to determine the cause of the spill. Initially the cause of the spill was a mystery, since the aircraft had been recently calibrated by MDA personnel for this spray operation. Upon inspection it was discovered that the contractor had capped 16 of 33 nozzles since the aircraft had been calibrated. It was speculated that this was done to complete spray operations in another state prior to arriving in Maryland. Consequently, the twin Beech had to respray the same acreage the next day. Final calculations determined approximately 60 gallons of Foray 48B was actually lost in the spill.

Another incident occurred when the mix crew for the fixed wing operation failed to shut a water valve for the mix tank during a diflubenzuron spray mission. The mistake was noticed by the Officer in Charge. It was determined the twin beech sprayed the acreage during this mission at 0.17 ounces of Active Ingredient (AI) per acre as opposed to the prescribed 0.32 ounces AI per acre. This acreage was resprayed at the contractors' expense.

All aircraft under contract to Maryland gypsy moth spray operations are restricted from other private or state operations unless officially released by MDA personnel. On May 14, the twin Beech left Maryland unauthorized to begin simultaneous spray operations in West Virginia and Wisconsin (?). The loss of this aircraft extended our operations. The contractor was fined for lost air spray time.

We were fortunate to have acceptable weather conditions for the first seven days of the spray season. However, wind and rain delayed or limited daily spray operations for the remainder of the spray season. The final spray operation was finished on

May 21st on the Eastern Shore.

We sprayed a total of 41,331 acres in 17 counties. This is the fewest acres sprayed by the state program in 11 years (Table 2). Foray 48B was sprayed on 25,424 acres at a specified dose of 24 BIU per acre. Of the B.t. acreage, 9,567 acres were sprayed neat. This is the first time MDA has tried neat B.t. applications on a large scale basis. We are awaiting efficacy results.

We used Dimilin in two formulations. Dimilin 25W was sprayed on 2,420 acres. This was previously purchased product which was used to eliminate our stockpile. The remaining 13,487 acres were sprayed with Dimilin 4L. In both cases the specified dose was 0.2 lb (0.32 oz) AI per acre

There were three categories of property ownership included in the 1993 spray season (Table 3). Privately owned county acres (CO_ACRES) accounted for approximately two-thirds (65.4%) of the program. State acreage amounted to 27.8% of the program with the remaining acreage attributed to FRPI (6.7%).

Overall, the consensus of MDA personnel is that the spray program went well. We have several entomologists specializing in different spray operation activities such as calibration, parasite evaluation and radio operations as well as their regional activities. Much of the state which had been devastated by gypsy moth defoliation in recent years was spared due to the population crash. However, MDA correspondence with citizens, elected officials and the media constantly points out that large gypsy moth populations are likely to return within a few years. Preliminary defoliation figures for 1993 indicate heavy defoliation on the Eastern Shore and low to moderate defoliation in other parts of the state.

Defoliation by Gypsy Moth 1982 - 1992

County	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Allegany	0	0	3,318	53,518	23,462	21,091	8,782	6,705	24,179	14,360	498
Anne Arundel	0	0	0	0	0	0	0	3,684	7,440	2,490	14
Baltimore	217	163	765	3,710	4,938	3,602	1,884	9,114	2,147	190	0
Baltimore City	0	0	0	0	0	0	0	0	0	0	0
Calvert	0	0	0	0	0	0	0	0	0	0	0
Caroline	0	118	3,017	3,568	2,040	3,273	6,223	10,324	10,822	8,314	4,764
Carroll	1	0	1,405	3,375	4,393	358	14	1,209	200	0	0
Cecil	7,522	3,881	1,833	904	2,352	4,854	1,831	935	3,447	5,291	35
Charles	0	0	0	0	0	0	0	0	0	134	169
Dorchester	0	0	0	0	0	1	19	110	846	8,717	17,711
Frederick	1,012	5,022	14,769	8,198	4,480	6,375	14,911	3,083	358	49	0
Garrett	0	0	0	0	4,574	6,502	1,074	13,877	36,705	9,813	0
Harford	1,678	1,214	1,229	352	1,066	1,336	165	4,909	3,547	639	0
Howard	0	0	0	0	84	97	218	8,285	5,080	92	0
Kent	0	646	5,195	2,333	1,417	3,355	3,425	6,632	10,656	2,073	247
Montgomery	0	0	0	181	1,197	1,649	4,001	8,278	3,417	323	0
Prince George's	0	0	0	0	0	0	96	3,398	2,840	1,040	379
Queen Anne's	0	808	4,700	3,813	1,397	4,330	9,961	17,001	15,050	2,697	3,061
Somerset	0	0	0	0	0	0	0	42	366	534	637
St. Mary's	0	0	0	0	0	0	0	0	0	0	0
Talbot	0	0	0	0	0	0	14	51	2,100	6,873	6,093
Washington	490	4,018	5,539	3,458	6,747	19,980	5,713	0	1,117	6,342	306
Wicomico	0	0	0	0	0	0	50	175	584	1,689	2,997
Worcester	0	0	0	78	43	0	132	102	2,161	3,523	1,793
Totals	10,920	15,870	41,770	83,488	58,190	76,803	58,513	97,911	133,062	75,180	38,704

TABLE - 2

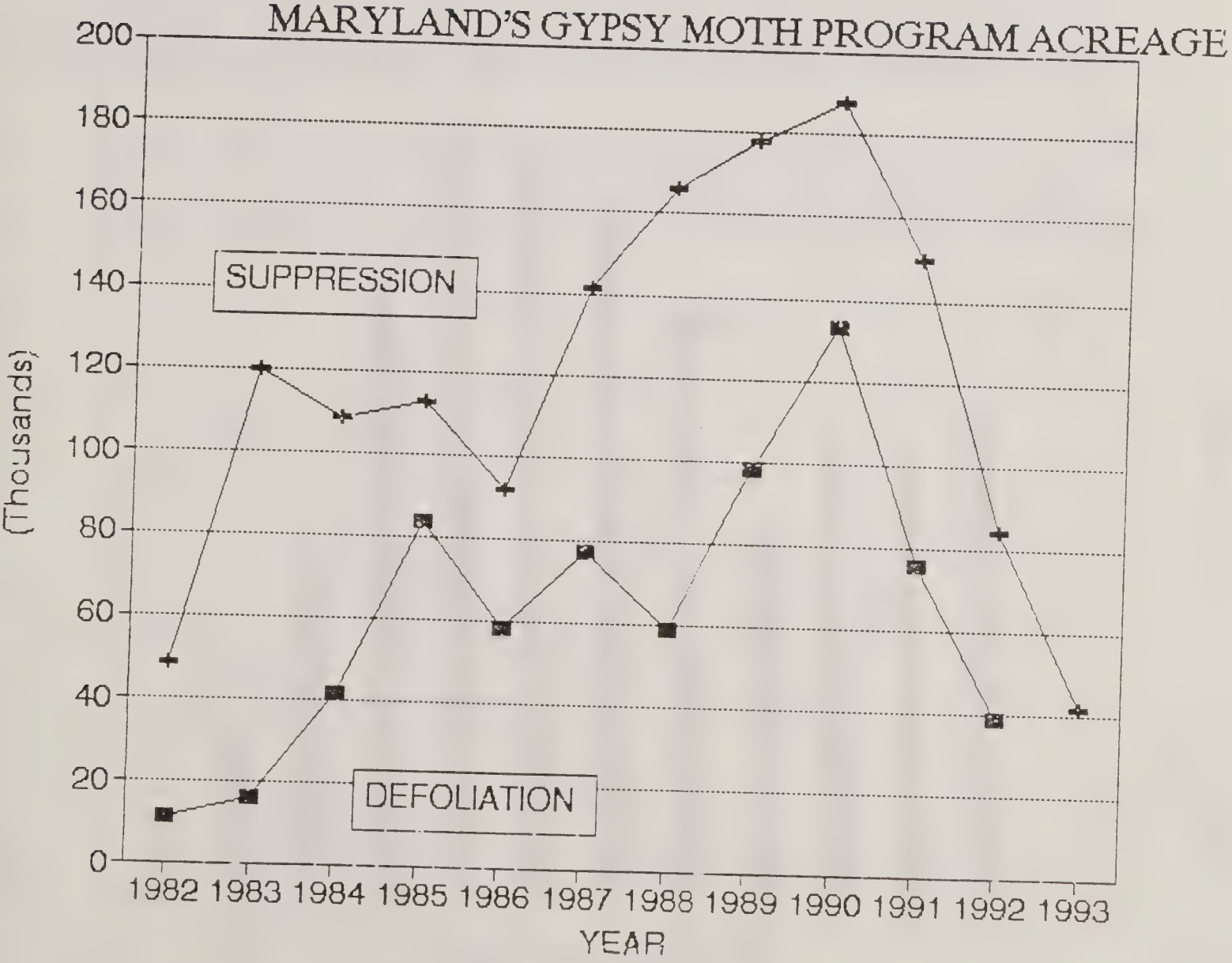
Maryland Gypsy Moth Cooperative Suppression Programs, 1985 - 1993

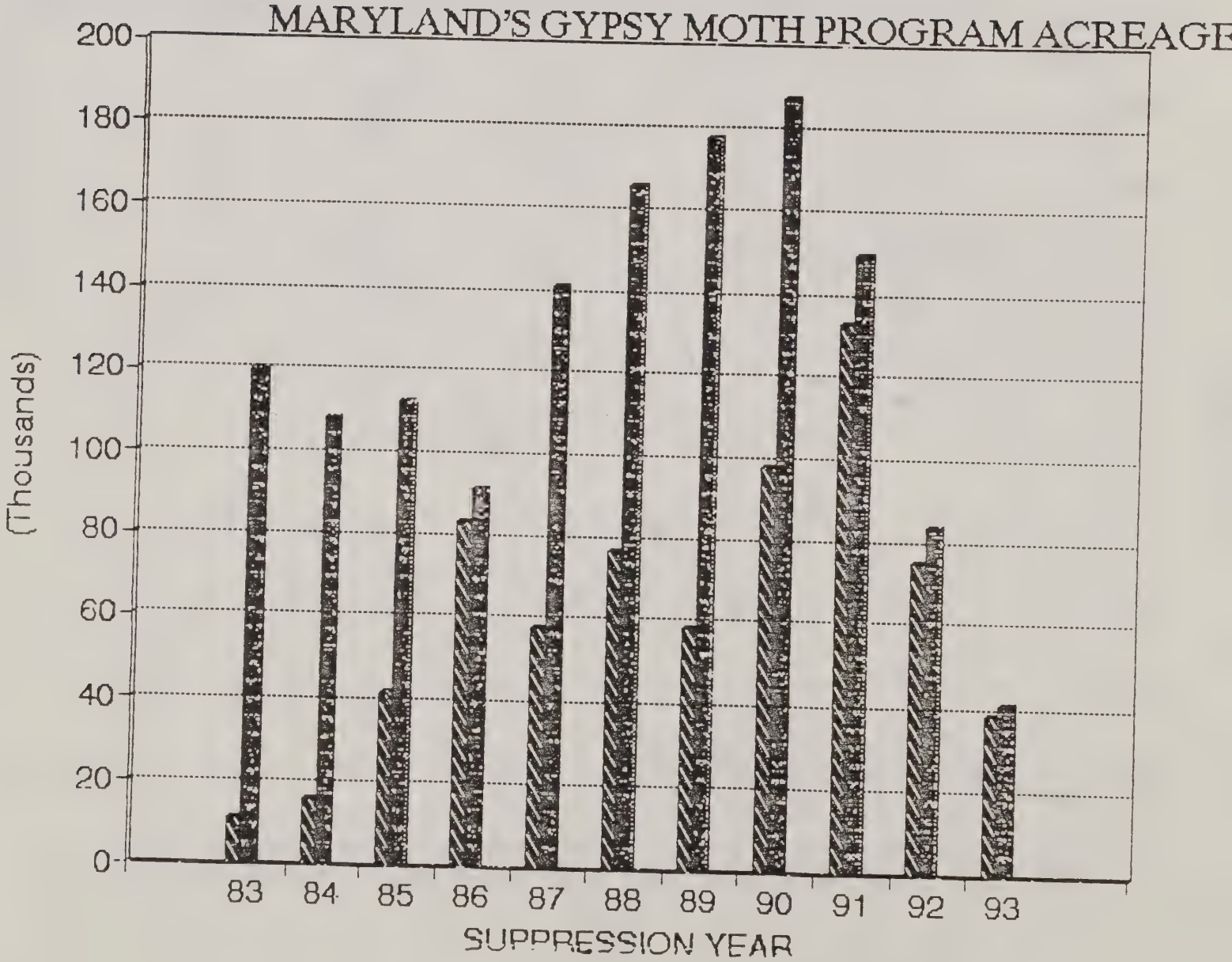
County	Acres Treated								
	1985	1986	1987	1988	1989	1990	1991	1992	1993
Allegany	26,399	27,269	32,731	26,778	15,502	12,619	28,501	11,630	6,262
Anne Arundel	553	252	638	9,084	6,476	13,490	12,139	12,028	3,140
Baltimore	6,493	6,082	10,204	7,064	15,748	16,459	7,755	1,445	626
Baltimore City	173	0	142	155	2,362	254	0	0	0
Caroline	4,655	7,802	5,455	5,860	6,467	14,832	7,926	1,864	2,744
Carroll	6,293	11,040	4,365	2,065	5,458	2,866	1,397	0	585
Cecil	16,669	5,524	3,155	18,241	8,725	6,298	9,076	7,121	512
Charles	0	0	0	26	0	308	1,800	4,434	2,577
Dorchester	0	0	45	30	113	0	2,121	2,464	781
Frederick	25,018	19,245	18,477	23,589	11,078	5,666	12,349	4,300	1,130
Garrett	0	4,381	24,758	29,402	36,956	33,678	14,907	10,354	0
Harford	1,407	1,887	4,254	1,398	6,311	10,300	7,388	4,194	0
Howard	0	172	474	766	7,410	10,584	3,556	0	0
Kent	3,650	735	3,768	403	4,272	4,581	6,439	3,219	2,347
Montgomery	672	2,333	4,446	11,488	26,089	20,500	10,474	2,040	581
Prince George's	96	0	0	3,161	8,898	11,244	1,080	1,132	0
Queen Anne's	5,233	3,414	4,229	4,932	6,488	6,825	6,634	153	337
St. Mary's	0	0	0	32	0	73	101	28	0
Somerset	0	0	59	0	51	229	27	86	150
Talbot	0	0	388	78	613	3,265	3,976	4,707	6,627
Washington	15,612	622	23,551	21,780	7,168	12,610	11,142	10,308	8,162
Wicomico	0	0	0	72	75	868	898	1,359	3,555
Worcester	110	730	0	0	1,547	174	600	1,308	1,215
Totals	113,033	91,488	141,139	166,404	177,807	187,723	150,286	84,174	41,331

TABLE 3

MARYLAND 1993 PROPERTY OWNER BREAKDOWN

COUN	TOTAL	CO_ACRES	STATE	FRPI	RESPRAY	SUPPRESSION
ALLE	6262	0	4347	1915	0	6262
ANNE	3140	3129	11	0	0	3140
BACO	626	154	472	0	0	626
CARO	2744	0	2744	0	0	2744
CARR	585	558	27	0	0	585
CECI	512	512	0	0	0	512
CHAR	2577	2252	325	0	0	2577
DORC	1038	0	0	781	257	781
FRED	1130	685	373	72	0	1130
KENT	2347	2347	0	0	0	2347
MONT	581	476	105	0	0	581
QUEE	337	0	337	0	0	337
SOME	150	150	0	0	0	150
TALB	7529	6588	39	0	902	6627
WASH	8162	5458	2679	25	0	8162
WICO	3627	3538	17	0	72	3555
WORC	1355	1197	18	0	140	1215
	42702	27044	11494	2793	1371	41331


MARYLAND'S GYPSY MOTH PROGRAM ACREAGE
(Thousands)
200
180
160
140
120
100
80
60
40
20
0
SUPPRESSION
DEFOLIATION
1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993
YEAR


MARYLAND'S GYPSY MOTH PROGRAM ACREAGE
200
180
160
140
120
100
80
60
40
20
0
(Thousands)
83
84
85
86
87
88
89
90
91
92
93
SUPPRESSION YEAR

Georgia Forestry Commission
1993 Gypsy Moth Treatment Summary

The 1993 GFC project involved treatment of 1,937 acres in northeastern Georgia (White County). This isolated infestation was detected in 1990, delineated in 1991 and first treated in 1992. The 1992 treatment of 5,250 acres was successful in reducing populations, but scattered male moths were trapped from within the treatment block following the application. In addition to the scattered captures within the 1992 treatment block, a concentration of multiple male captures occurred to the northeast of the 1992 treatment area. Egg mass surveys in this area were positive, so another treatment was implemented in 1993.

The 1993 contract was helicopter only, with the contractor providing the Bt, each acre treated twice with undiluted Bt at 24 BIU's per acre. The contract specified Novo's Foray 48B as the only acceptable product. The contract was awarded to Steve Coker of Movren, GA at a bid price of $43,621 ($11.26 per acre per application). The contractor provided a Hiller 12E Soloy spray ship, a Bell 206 observation ship, ground support equipment and crew. The 1st treatment was applied on April 26 and 27, and the 2nd treatment was applied on May 4. Populations were so sparse that no larvae could be found, so spray timing was a a best guess using foliage expansion as an indicator (white oaks 25% expanded at the start of the 1st application).

Treatment evaluations are in progress at this time. A 42 square mile delimiting grid of 16 traps per square mile has been deployed. Mass trapping at 9 traps per acre has been implemented on 3 separate areas as well. All total, about 900 traps were deployed in connection with this infestation during 1993. As of July 16 when a complete check of the mass trapping grids and a partial check of the delimiting grid was completed, no moths have been trapped.

STATE OF MICHIGAN

Commission of Agriculture
David Crumbaugh
John A. Spero
Keith H. McKenzie
Donald W. Nugent
Rita M. Reid

JOHN ENGLER, Governor

DEPARTMENT OF AGRICULTURE

P.O. BOX 30017, LANSING, MICHIGAN 48909

BILL SCHUETTE, Director

1993 Gypsy Moth Suppression Program

PROJECT REVIEW

Treatment Operations:

Participants:	31 counties; MI Dept. of Military Affairs; MI Dept. of Natural Resources
Contractors:	Aircare Aviation, Inc., Michigan Al's Aerial Spraying, Michigan Earl's Spray Service, Inc., Michigan Hatfield Spraying Service, Inc., Michigan Maurice's Flying Service, Inc., Michigan Bob Ruhe Ag Service, Inc., Ohio
Aircraft:	19 fixed wing aircraft
Dates:	17 May through 11 June
Method:	all material applies undiluted with rotary atomizers

Materials/rates:	BIU/acre	Acres
Dipel 6AF	16	33,520
Foray 48B	16	197,405
		230,930

Calibration and characterization of all aircraft occurred within two weeks of treatment. Initial calibration of booms was

accomplished using water. Once uniform nozzle flow was attained booms were attached to a trough system for a final calibration of pressure and flow rate using contracted products. Booms were then mounted on aircraft and characterized using the Swath Kit. Larry VanDyke representing Abbott Lab and Temple Bowen representing Novo Nordisk were on-site during portions of the operation.

This years area of operation expanded both south and north (see attached map) and included ten new counties. Treatment extended over 26 days with 8 no-spray days due to wind or rain. We experienced no difficulties applying either materials though post-treatment weather did cause concern. On several of the treatment days, especially in Lake Michigan bordering counties, daily highs hovered around 60 degrees F. This temperature pattern persisted for several days after treatment raising the question of treatment efficacy. By early July treatment in those areas appeared to have been effective.

During operations three incidents occurred: 1) a telephone threat to shoot the treatment aircraft for violating the resident's "air space". The sheriff contacted resident but the pilot declined to press charges; 2) a threat to shoot a county coordinator while setting a balloon. The coordinator calmed the property owner though did not set the balloon; 3) a loading spill of 5-15 gallons of B.t. The hose was detached from the plane prior to the pump being turned off.

Three sites near federally threatened bird species were allowed to be treated by Fish & Wildlife Service using special precautions: 1) winds directed away from habitat and no greater than 5 MPH; 2) fixed-wing aircraft be used; 3) representatives of Fish & Wildlife Service, National Forest, and MI Dept. of Natural Resources to be notified prior to treatment dates. Treatment of these sites proceeded as planned.

After treatment critiques were held with MDA staff then with each contractor and their contracted counties. Two significant concerns were identified this year: 1) reduction of acres after contract awarded; 2) poor balloon setting at some sites. These issues are being referred to the suppression program steering committee to resolve. With the exception of the noted incidents this years treatment operation was accomplished with relative smoothness.

Submitted by:

Ronald J. Priest, Manager
Gypsy Moth Program 517/373-9751

19 July 1993

MICHIGAN DEPARTMENT OF AGRICULTURE
PESTICIDE & PLANT PEST MANAGEMENT DIVISION

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LANSING, MICHIGAN 48909
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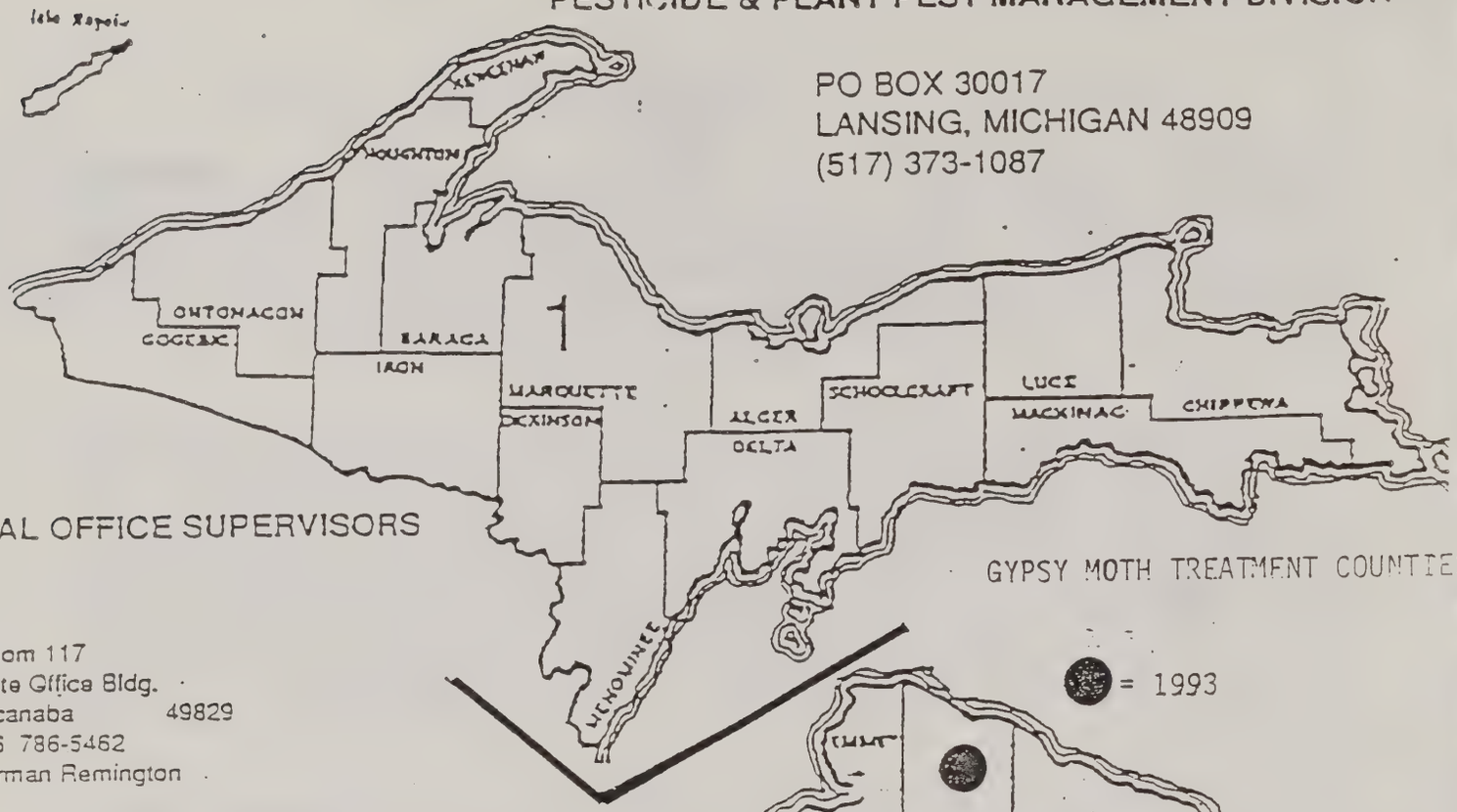

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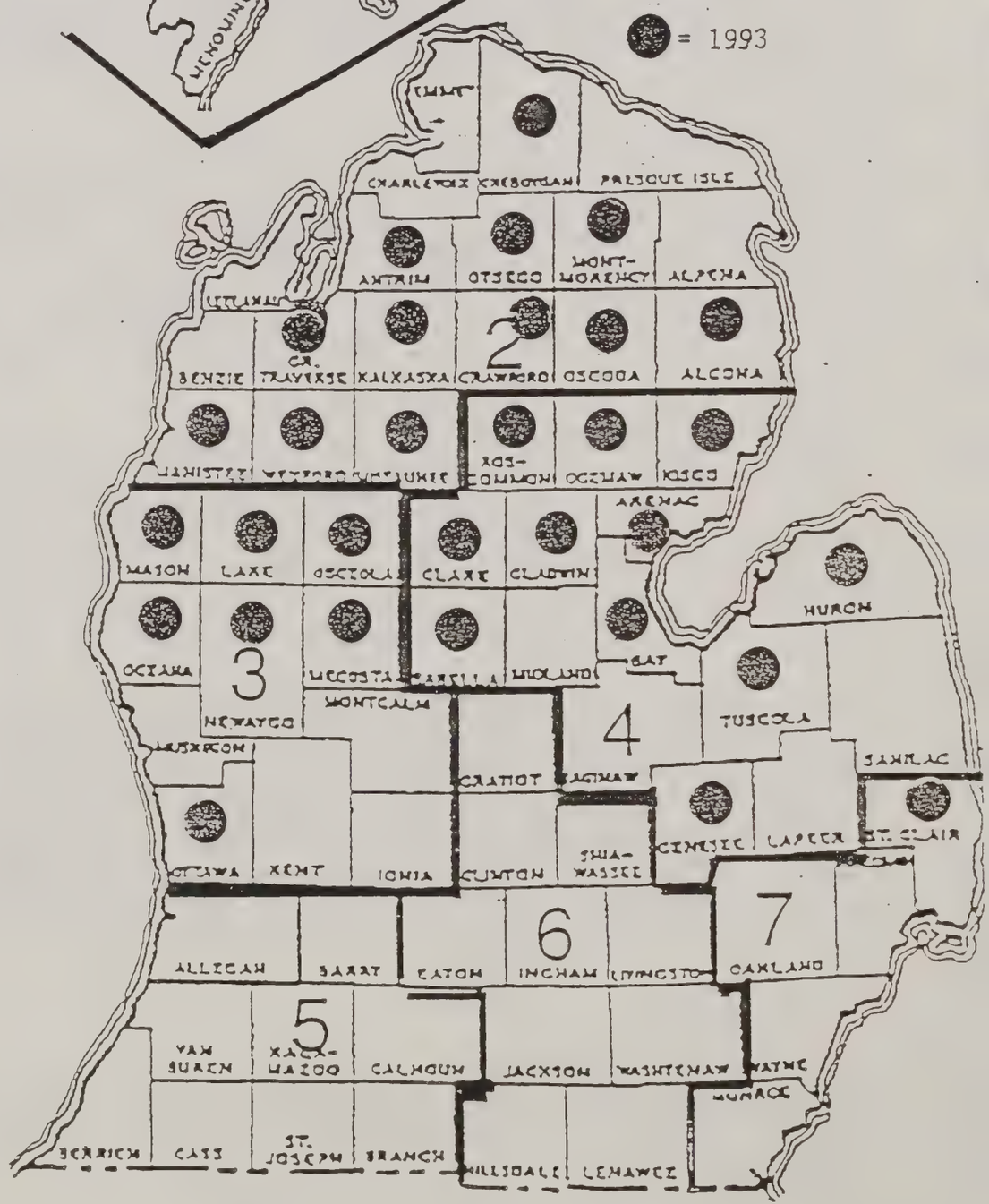
GYPSY MOTH TREATMENT COUNTIES

= 1993



Rev. 7/13/93

1993 SPRAY COSTS/REIMBURSEMENTS

COUNTY	NO. ACRES	CONT. PRICE	SPRAY COSTS	estimated ADMIN. COSTS	estimated PER ACRE ADM. COST	estimated TOTAL COSTS	estimated PER ACRE COSTS	estimated REIMB. AMOUNT	INIT. PAYMENT	2ND PAYMENT
ALCONA	2,231	4.23	9,437.13	6,693.00	3.00	16,130.13	7.23	8,065.07	10,039.50	(1,974.43)
ANTRIM	240	5.00	1,200.00	720.00	3.00	1,920.00	8.00	960.00	1,080.00	(120.00)
ARENAC	5,918	4.68	27,696.24	17,754.00	3.00	45,450.24	7.68	22,725.12	26,631.00	(3,905.88)
BAY	845	4.68	3,954.60	100,000.00	118.34	103,954.60	123.02	51,977.30	3,802.50	48,174.80
CHEBOYGAN	12,446	4.68	58,247.28	37,338.00	3.00	95,585.28	7.68	47,792.64	56,007.00	(8,214.36)
CLARE	26,692	4.17	111,305.64	69,399.20	2.60	180,704.84	6.77	90,352.42	90,352.42	0.00
CRAWFORD	5,752	6.40	36,812.80	17,256.00	3.00	54,068.80	9.40	27,034.40	25,884.00	1,150.40
GENESEE	970	4.00	3,880.00	25,000.00	25.77	28,880.00	29.77	14,440.00	4,365.00	10,075.00
GLADWIN	17,221	4.93	84,899.53	51,663.00	3.00	136,562.53	7.93	68,281.27	77,494.50	(9,213.24)
GRAND TRAVER	8,626	4.94	42,612.44	25,878.00	3.00	68,490.44	7.94	34,245.22	38,817.00	(4,571.78)
HURON	649	4.00	2,596.00	19,000.00	29.28	21,596.00	33.28	10,798.00	2,920.50	7,877.50
IOSCO	14,171	3.98	56,400.58	42,513.00	3.00	98,913.58	6.98	49,456.79	63,769.50	(14,312.71)
ISABELLA	2,066	4.93	10,185.38	6,198.00	3.00	16,383.38	7.93	8,191.69	9,297.00	(1,105.31)
KALKASKA	3,922	5.00	19,610.00	11,766.00	3.00	31,376.00	8.00	15,688.00	17,649.00	(1,961.00)
LAKE	14,109	4.24	59,822.16	42,327.00	3.00	102,149.16	7.24	51,074.58	63,490.50	(12,415.92)
MANISTEE	1,450	6.13	8,888.50	4,350.00	3.00	13,238.50	9.13	6,619.25	6,525.00	94.25
MASON	3,722	5.25	19,540.50	11,166.00	3.00	30,706.50	8.25	15,353.25	16,749.00	(1,395.75)
MECOSTA	5,718	4.63	26,474.34	45,000.00	7.87	71,474.34	12.50	35,737.17	25,731.00	10,006.17
MISSAUKEE	3,667	4.63	16,978.21	11,001.00	3.00	27,979.21	7.63	13,989.61	16,501.50	(2,511.90)
MONTMORENCY	20,130	4.23	85,149.90	60,390.00	3.00	145,539.90	7.23	72,769.95	90,585.00	(17,815.05)
NEWAYGO	2,825	4.98	14,068.50	8,475.00	3.00	22,543.50	7.98	11,271.75	12,712.50	(1,440.75)
OCEANA	1,412	5.19	7,328.28	4,236.00	3.00	11,564.28	8.19	5,782.14	6,354.00	(571.86)
OGEMAW	8,329	4.68	38,979.72	24,987.00	3.00	63,966.72	7.68	31,983.36	37,480.50	(5,497.14)
OSCEOLA	3,496	4.24	14,823.04	10,488.00	3.00	25,311.04	7.24	12,655.52	15,732.00	(3,076.48)
OSCODA	8,974	4.23	37,960.02	26,922.00	3.00	64,882.02	7.23	32,441.01	40,383.00	(7,941.99)
OTSEGO	23,808	4.57	108,802.56	71,424.00	3.00	180,226.56	7.57	90,113.28	107,136.00	(17,022.72)
OTTAWA	1,866	5.14	9,591.24	5,598.00	3.00	15,189.24	8.14	7,594.62	8,397.00	(802.38)
ROSCOMMON	18,154	4.47	81,148.38	54,462.00	3.00	135,610.38	7.47	67,805.19	81,693.00	(13,887.81)
ST.CLAIR	347	4.00	1,388.00	1,041.00	3.00	2,429.00	7.00	1,214.50	1,561.50	(347.00)
TUSCOLA	579	4.00	2,316.00	14,250.00	24.61	16,566.00	28.61	8,283.00	2,605.50	5,677.50
WEXFORD	7,033	4.63	32,562.79	58,000.00	8.25	90,562.79	12.88	45,281.40	31,648.50	13,632.90
DNR	1,562	9.63	15,042.06	4,686.00	3.00	19,728.06	12.63	4,932.02	3,514.50	1,417.52
DMA	2,000	6.40	12,800.00	6,000.00	3.00	18,800.00	9.40	4,700.00	4,500.00	200.00
TOTAL	230,930	4.60	1,062,501.82	895,981.20	3.88	1,958,483.02	8.48	969,609.50	1,039,185.00	(31,799.42)

1993 NEW JERSEY GYPSY MOTH PROGRAM

The 1993 Gypsy Moth Aerial Suppression Program began on May 7th in Salem and Cumberland Counties in Southern New Jersey and ended on May 21st in North Jersey in Morris County.

A total of 12,342 acres of municipal property were treated using a single NEAT application of 24 BIU's of B.T. at ½ gal/ac. costing $9.59/Ac. by Downstown Aerocrop Services.

Using two Grumman 600 Agcats, Dipel 6AF was applied on 19 southern spray blocks totaling 5716 acres in Burlington, Cape May, Cumberland and Salem Counties.

Spraying in the three northern counties began on May 14th using two Grumman Agcats. A Twin Beech, from K&K Aircraft, was used in the congested areas. Eleven spray blocks were treated with Foray 48B in Morris, Passaic and Sussex Counties totaling 6626 acres.

The program went smoothly with no incidents to report, the only delays in the program were due to low ceilings and rainy weather that are commonplace during this time of year.

All treated areas exhibited good levels of foliage protection except in areas that had very high populations of caterpillars.

The Aerial Defoliation Survey began around the end of June in Southern New Jersey. At this time, 26,910 acres of municipal forest land mostly in Cape May, Cumberland, Salem and Atlantic Counties exhibit severe levels of defoliation. The results of the survey are not completed at this time, but they are expected to be below 1992 levels especially in the northern counties.

1993 Aerial Defoliation Survey
Acreage Totals

	I.D.	HF	MF	SF	SW	Total
Atlantic	(2500 Ac.)					
Estell Manor	0109	-	-	2410	90	2500
Cape May	(1170 Ac.)					
Dennis	0504	-	-	685	-	685
Middle	0506	55	-	430	-	485
Cumberland	(15,750 Ac.)					
Commercial	0602	390	-	5720	-	6110
Downe	0604	1015	-	5255	15	6285
Fairfield	0605	-	-	60	-	60
Greenwich	0606	240	-	-	-	240
Lawrence	0608	240	320	280	-	840
Maurice Riv	0609	1780	345	90	-	2215
Mercer	(40 Ac.)					
E.Windsor	1101	35	-	-	-	35
W.Windsor	1113	5	-	-	-	5
Middlesex	(205 Ac.)					
E.Brunswick	1204	205	-	-	-	205
Monmouth	(285 Ac.)					
Millstone	1332	225	-	25	-	250
Roosevelt	1341	35	-	-	-	35
Salem	(7205 Ac.)					
Alloway	1701	180	75	185	-	440
Carneys Pt.	1713	45	-	-	-	45
L.Alloway Ck	1704	75	705	225	100	1105
Oldmans	1706	685	-	-	-	685
Pittsgrove	1710	5	-	60	-	65
Quinton	1711	1235	1745	-	1560	4540
U.Pittsgrove	1714	195	130	-	-	325

GRAND TOTAL (South Jersey) 26,910 Ac.

NORTH CAROLINA

1993 GYPSY MOTH TREATMENTS

Aerial Applications:

Aircraft: Turbine Twin Beech

Material: Foray 48B

Dates: April 28 thru May 4

Nozzles: 8006 FF (33) for the 30 BIU application
(27) for the 24 BIU application
40 psi
135 degree forward orientation

County	Acres	Rate	Applications
Halifax	3200	24 BIU	2
Currituck	360	30 BIU	1

Ground Applications:

Material: Foray 48B or
Dimilin 25W

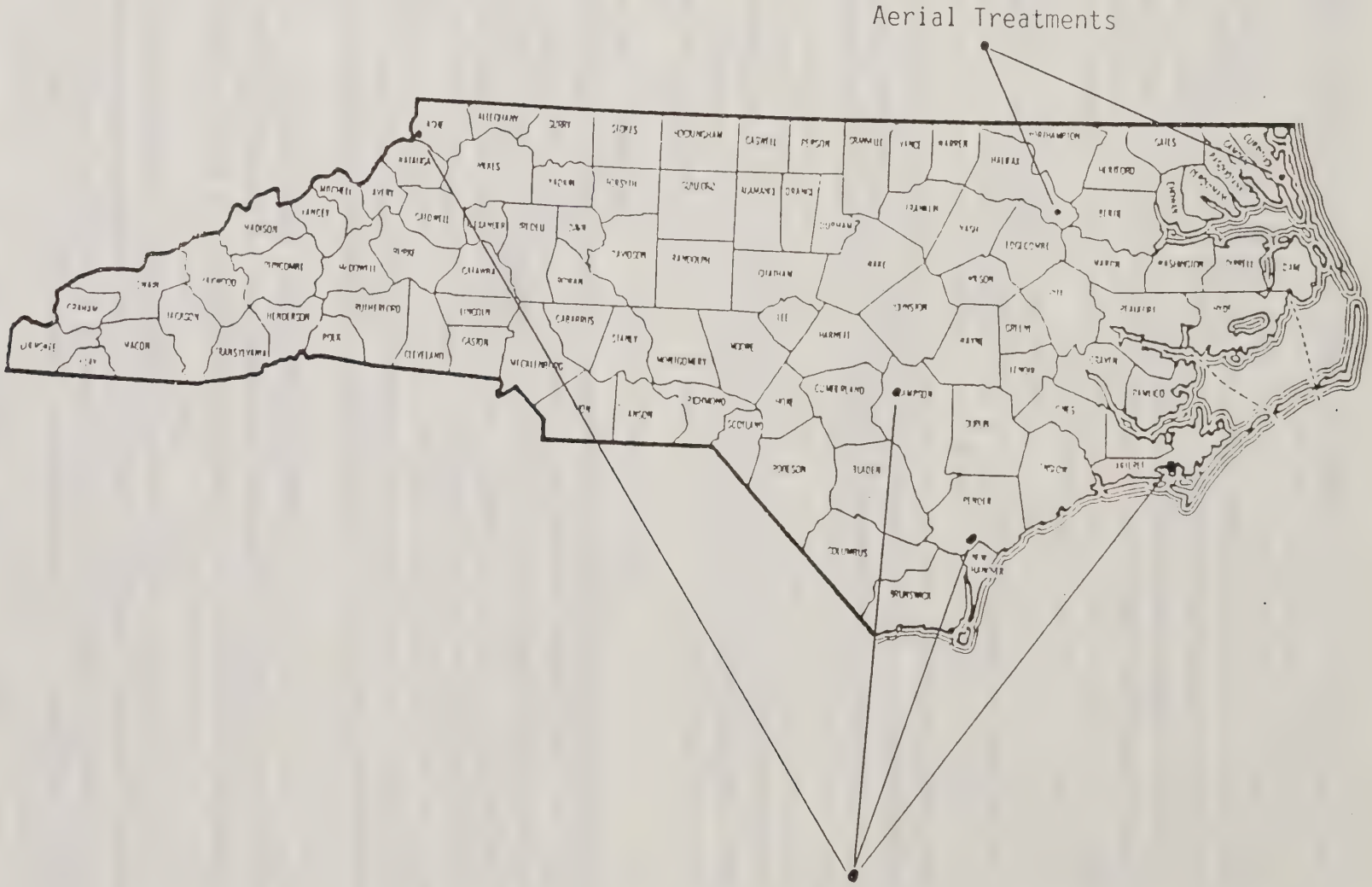
Dates: April 23 thru May 27

Equipment: John Bean Mist Blower
Hydraulic Sprayer (Carteret Co. only)

County	Acres	Applications	Material	Rate/Acre
Pender	5	3	Bt	36 BIU
Sampson	5	2	Dimilin	2 oz.
Carteret	4	1	Bt	36 BIU
Ashe	3	2	Bt	36 BIU

NORTH CAROLINA

1993 Gypsy Moth Treatments



Ohio Suppression Summary 1993

Allen Baumgard
Gypsy Moth Program Manager
Ohio Department of Agriculture

Suppression acreage for Ohio in 1993 were a little less than in 1992. The biggest reason for this was due to the virus having a big impact in two of our largest defoliated blocks. It knocked the population down to levels were it was barely detectable, even though those areas were completely defoliated. This saved us from spraying at least 2,000 acres.

We had a large eradication site at the Mohican Memorial State Forest in Ashland county. This site consisted of 550 acres, treated with two applications of Bt. Total acreage sprayed by ODA in 1993 was about the same as in 1992.

Our public involvement/participation process involved the Ohio Gypsy Moth Management Council (OGMMC), the county Advisory Committees, and the public Open Houses. The OGMMC membership is made up of several gypsy moth related disciplines, with this being the more scientific group. The Advisory Committees are the county level input that also help the county commissioners in their decision making. The Open Houses are what we put on to allow the public direct access to us and the decision making process. We feel we get good, useful input from the participants and less emotional responses that lack scientific basis in this format. The Open Houses are manned by our staff as well Extension and Forestry personnel.

With all these groups involved in the decision making process, a lot of emotion has been taken out of the debate and issues have become more factually based. We have seen less public criticism and better public acceptance of suppression activities since adopting this format.

With our limited acreage to treat and the good working relationship we have with the Ohio Department of Transportation (ODOT), we decided to use the state helicopter and pilot again for 1993. This will probably be the last year we use this helicopter for large areas. ODOT is talking about buying a Jet Ranger to spray with and we would consider using this aircraft, otherwise, we will be contracting out in 1994. On a positive note, the Hiller didn't give us any problems this year.

Overall, the spray activities went well accept for a few days of bad weather. We started our suppression treatments on May 17th and finished on the 27th. The eradication site was treated on May 14th for the first application with the second application occurring on May 26th. We used Dimilin 4L at 1/2 oz. ai per acre and Foray 48B at 24 BIU's per acre in our treatments (see table 1 for the breakdown of what went where). Both insecticides were mixed with one gallon of water per acre.

Following is a listing of the sites and the insecticide used.

Ohio Department of Agriculture
1993 Suppression Acres

TABLE 1

SITE	B.t. Acres	Dimilin Acres	Egg Masses per acre	Private Acres	Federal Acres	State Acres
ASHTABULA CO						
Andover	1188		6768	1139	0	49
Dorset 1		250	2550	250	0	0
Dorset 2		1938	6592	1938	0	0
Harpersfield	211		1570	211	0	0
Kingsville		384	3840	384	0	0
GEAUGA CO.						
Burton		166	5000	166	0	0
LAKE CO.						
Hermitage	301		1140	301	0	0
TOTALS	1700	2738		4389	0	49

Eradication acres: ASHLAND COUNTY

Mohican Memorial State Forest 550 acres

Two Applications (1,100 acres)

We have just completed our aerial survey and are still compiling the results but early indications suggest our totals for 1993 are going to be slightly lower than 1992, although it is over a larger area. It has now reached into our Oak-hickory forests of Eastern and Southeastern Ohio. I expect to see some dramatic changes in the next few years now that it is moving from our Maple-beech forests into the Oak-hickory forests. I expect it will spread faster and cause more damage over larger areas as it moves through eastern and southeastern Ohio.

I believe the people in Northeast Ohio are now beginning to cope with the gypsy moth. They don't seem to be getting as excited as they first were, although we still haven't had a bad outbreak in a forested or residential area.

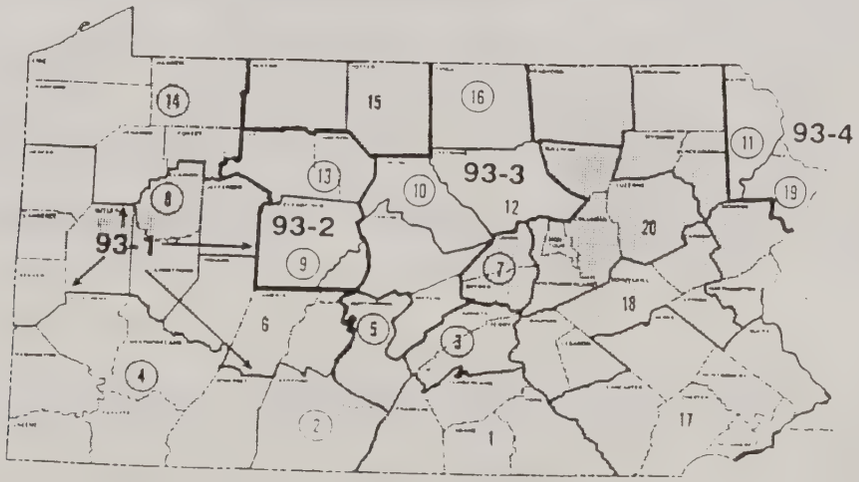
On a related topic, we started a joint *E.m.* fungus project with Dr. Barry Hunter, out of the California University of Pennsylvania, California, PA. With him, we have set up five research sites to introduce the fungus, to see if it survives after introduction, and to check its dissemination, We have found fungus infected larvae at some of the sites this year with 1994 being the telltale year. The sites were put in both low and high population areas. After some more research has been done and its effectiveness proven, I would like to see this integrated into the IPM cost-sharing we now do with the Forest Service.

PENNSYLVANIA BUREAU OF FORESTRY

1993 GYPSY MOTH SUPPRESSION PROJECT SUMMARY

Acres Treated by Ownership and Insecticide

Ownership	Bt		DFB		Total	
	Acres	Blocks	Acres	Blocks	Acres	Blocks
Private	25,053	255	0	0	25,053	255
State Forest	3,086	11	78,857	74	81,943	85
State Park	602	8	0	0	602	8
Federal	33	3	0	0	33	3
Other	1,185	5	0	0	1,185	5
Totals	29,860	282	78,857	74	108,717	356



Spray Aircraft Used

Contract 93-1
2 - Bell 206

Contract 93-2
1 - Dromader M18A
1 - Thrush S2R

Contract 93-3
1 - Bell 206
1 - Bell Soloy

Contract 93-4
1 - Bell 204
1 - Bell Soloy

Start/Stop Dates

Start: May 10, 1993 (Contract 93-3, District 3, Mifflin County)
Finish: May 26, 1993 (Contract 93-2, District 13, Cameron County)

Insecticides

Bt - Dipel 6AF, 24 BIU, 64 ounces/acre undiluted (18,405 acres)
36 BIU, 96 ounces/acre undiluted (9,002 acres)
Foray 48B, 36 BIU, 96 ounces/acre undiluted (2,453 acres)

DFB - Dimilin 4L, .25 ounce AI, 1 gallon/acre diluted (78,857 acres)

DER CONTRACT COSTS - 1993 GYPSY MOTH SUPPRESSION PROJECT

Contractor	Contract	Bid Price		Acres Treated		Extra*		Actual Cost/Acre		Contract Cost		
		Bt	DFB	Bt	DFB	Bt	DFB	Bt	DFB	Bt	DFB	Total
AgRotors, Inc. Gettysburg, PA	93-1	$12.67 (36 BIU)	-	9,002	-	5	-	$12.68	-	$114,118.69	-	$114,118.69
Tallman Aerial Spraying Dauphin, PA	93-2	-	$3.49	-	55,826	-	0	-	$3.49	-	194,832.74	194,832.74
Tallman Aerial Spraying Dauphin, PA	93-3	8.98 (36 BIU)	3.97	2,453	23,031	0	0	8.98	3.97	22,027.94	91,433.07	113,461.01
Helicopter Applicators, Inc. Frederick, MD	93-4	7.78 (24 BIU)	-	18,405	-	730	-	8.09	-	148,870.30	-	148,870.30
Totals/Averages	All	$ 9.35 ($ 7.78-24) ($11.88-36)	$3.63	29,860 (18,405-24) (11,455-36)	78,857	735 (730-24) (5-36)	0	$ 9.55 ($ 8.09-24) ($11.89-36)	$3.63	$285,016.93 ($148,870.30-24) ($136,146.63-36)	$286,265.81	$571,282.74

Total Acres Treated - 108,717
Average Cost/Acre - $5.25

*Resprays and calibration adjustments--expressed as acre equivalents.

Tennessee Department Of Agriculture
1993 Gypsy Moth Treatment Summary

The Tennessee Department of Agriculture (TDA) in cooperation with the USDA, FS and APHIS, treated 2 isolated infestations in eastern Tennessee during 1993. The larger infestation, 840 acres located in Washington County near Kingsport, was treated by a contractor with double applications of Bt. The smaller infestation, 155 acres located in Sequatchie County just north of Chattanooga, was treated with Gypchek using an APHIS pilot and plane.

Sequatchie County Project

History: This infestation was first delineated and treated in 1990. The 1990 treatment was a combination of a Dimilin ground spray of the core area and aerial application of Hercon's Disrupt II at 30 g AI/acre on the surrounding 200 acres. Follow-up trapping yielded 6 moths, all singles trapped outside of the treatment area. Trapping during 1991 yielded 7 moths from 6 traps, all located in the mass trapping grid that was deployed over the original core of the infestation, but egg mass surveys conducted that fall were negative. During 1992 the number of moths trapped increased to 39. Again all the moths were trapped at the core of the original infestation. A total of 3 viable egg masses were located, and a treatment block of 155 acres was laid out.

Treatment: This site was selected by APHIS to use as a test block to evaluate the efficacy of Gypchek on low-density populations. The application was made using an APHIS Ag Truck calibrated to deliver 2 gallons per acre. The first application was made on May 6 when most of the larvae were still in the first instar. The 2nd application was made 2 days later on May 8. Post-treatment evaluation includes a 9 square mile delimiting grid of traps at 16 traps per square mile, mass trapping at 9 traps per acre on 10 to 20 acres surrounding the core, and burlap banding at the core. Results are not yet available.

Washington County Project

The Washington County infestation was first detected in 1990 and delineated in 1991 but field surveys for other life stages were negative so no treatment was initiated in 1992. Instead the area was again delimited, the re-surveyed for other life stages. A single, viable egg mass was located and the source of the infestation was determined to be an RV from Maryland.

The TDA contract for double applications of Bt at 24 BIU's per acre was awarded to Harold's Flying Service of Leland, IL. at a cost of approximately $14 per acre per application. The contractor provided an Ag-Cat spray ship, the Bt (Novo Foray 48B), and ground support equipment and crew. The state provided the aerial observation ship. The spray ship was outfitted with 12 "no name" mini rotary atomizers and was calibrated to deliver 0.5 gallons per acre of undiluted Bt. The 1st application was made on April 29 and the 2nd application was completed on May 7.

During delivery of the first 200 gallon load, a hose blew on the belly of the aircraft. The ship returned to the airport for repairs. While trying to fix the hose, the ground support person inadvertently released the dump valve and approximately 185 gallons of Bt spilled onto the turf at the edge of the runway. Once the spill had been dealt with, the ship was reloaded and sent back to the block to continue spraying. After each of the 2 loads required for the 1st treatment, several of the rotary atomizers were frozen and had to be replaced. The pilot consulted with the manufacturer of the mini atomizers who was surprised to learn of our problems. His only explanation was that he had changed machine shops for the manufacture of this particular set of nozzles. The manufacturer offered to send an additional set of nozzles that had been tested in the field for 2 seasons. The new/used nozzles were used for the 2nd application and no further trouble was experienced.

WEST VIRGINIA DEPARTMENT OF AGRICULTURE
PLANT INDUSTRIES DIVISION
1993 GYPSY MOTH SUPPRESSION
ACRES TREATED AS OF MAY 21, 1993

Cooperative State-County-Landowner Program	Dimilin	B.t.k.	Total
Jefferson County	80	0	80
Berkeley County	6,102	168	6,270
Morgan County	12,627	502	13,129
Hampshire County	16,085	0	16,085
Mineral County	3,567	500	4,067
Grant County	2,146	0	2,146
Hardy County	14,436	1,920	16,356
Pendleton County	920	0	920
Hancock County	265	0	265
Brooke County	160	0	160
Preston County	2,027	0	2,027
Total	58,415	3,090	61,505

WVDA Regulatory Program	Dimilin	B.t.k	Total
Lewis County	120	0	120
Grand Total	58,535	3,090	61,625

WEST VIRGINIA DEPARTMENT OF AGRICULTURE

NEWS RELEASE

Gus R. Douglass, Commissioner

Robert G. "Bob" Morris, Assistant Commissioner

For Immediate Release

May 28, 1993

GYPSY MOTH SUPPRESSION PROGRAM COMPLETED

CHARLESTON, W.Va. — Agriculture Commissioner Gus R. Douglass announced the completion of the first part of this year's effort to slow the spread and reduce the impact of the gypsy moth in West Virginia.

The last part of the 1993 program will be conducted around the third week of June in Monroe County with treatment of 237 acres with pheromone flakes.

The program just completed treated 61,625 acres of forested land in Jefferson, Berkeley, Morgan, Hampshire, Mineral, Grant, Hardy, Pendleton, Hancock, Brooke, Preston and Lewis Counties. The treatment began on May 7 and was completed on May 20.

The spray program was a cooperative effort of the West Virginia Department of Agriculture (WVDA), United States Forest Service, West Virginia University Cooperative Extension Service, and county commissions and private landowners in the areas treated.

The Cooperative State-County-Landowner Program accounted for 61,505 acres of the total acreage treated. In the WVDA Regulatory Program, 120 acres were treated in the Lewis County area.

Two insecticides were used during this project. The insect growth regulator Dimilin (diflubenzuron) was applied to 58,535 acres and B.t.k. (Bacillus thuringiensis var. kurstaki) was applied to 3,090 acres, WVDA Entomologist J. D. Hacker said.

For more information on the Gypsy Moth Suppression Program, contact WVDA, Plant Industries Division at (304) 558-2212.

-30-

State Capitol, 1900 Kanawha Boulevard, East, Charleston, West Virginia 25305; (304) 558-2201

Mike McManus

United States Department of Agriculture | Forest Service | NE-HAMDEN

Reply to: 4500

Date: August 19, 1993

Subject: National Steering Committee - Gypsy Moth and Eastern Defoliators

To: John W. Barry, Chairperson

Jack, here is a copy of my report, along with two study abstracts that can be listed either at the end of my report or in an Appendix. If you need any additional information, let me know SAP as I will be away August 23 - 27; however, I will be in the office briefly on the morning of August 30.

I look forward to seeing you in Salt Lake City.

/s/MICHAEL L. MCMANUS
Project Leader

Encl

cc: M. McFadden

Report to
National Steering Committee - Gypsy Moth and Eastern Defoliators

The name of the NEFES Hamden, CT. Laboratory, Center for Biological Control of Northeastern Forest Insects and Diseases, has been changed to the Northeastern Center for Forest Health Research. This change was made to reflect the increased agency emphasis on Forest Health Protection and Ecosystem Management, and our commitment to provide research support to the National Center of Forest Health Management in Morgantown, W.VA.

A summary of FY-93 activities for Research Work Unit 4502, Pathology and Microbial Control, is provided in the following overview.

A. GYPCHEK

Field Studies

1. Two separate studies involving GYPCHEK, the gypsy moth nucleopolyhedrosis virus product, were conducted on replicated 12 ha plots in Michigan. One study compared the standard dose of GYPCHEK (2×10^{11} OB's/A) to several reduced doses with the optical brightener, (Blankophor) formulated by American Cyanamid Corp.

The second study compared the standard GYPCHEK tank mix ($5X\ 10^{11}$ OB's) applied twice to a ready-to-use formulation provided by Entotech, Inc. at the same dose and at a reduced dose. Study abstracts for these studies are provided for inclusion in the Appendix of this report.

2. Unit scientists cooperated with ARS scientists to formulate and apply Gypchek with and without the optical brightener in both ground and aerial studies in Maryland and West Virginia.

3. The first-ever field release of a genetically engineered gypsy moth virus was approved by the EPA and conducted on Camp Edwards, Cape Cod, MA. by a team of Forest Service and University cooperators who were funded through the Gypsy Moth Extramural Research Program. The objectives of this study are to determine the spread and persistence of a genetically-engineered virus in a forested environment.

Operational Studies

The gypsy moth virus, GYPCHEK, was produced at the APHIS Otis Methods Development Center under contract by the Forest Service, and processed and pre-packaged at the Forest Service Processing facility at Ansonia, Ct. Approximately 4,000 acre-equivalents (AE) were provided for treatment on environmentally sensitive lands; 155 AE's were used on an APHIS eradication project in Tennessee, and an additional 1 kg. of product was sent to Dr. Herman Bogenschutz in the Federal German Republic for inoculative treatments against outbreak gypsy moth populations in Germany.

B. Bacillus thuringiensis (Bt)

A simulated field study was initiated by Norm Dubois, with cooperators from FPM and the University of Connecticut, to measure the degradation of Foray 48B on foliage, caused by UVB-1 in natural sunlight in the range of 280-320nm. The periodic degradation of spore viability, insecticidal crystal protein concentration (delta endotoxin), and insecticidal activity of Bt were recorded over a 72-96 hr. period; the UVB-1 spectrum was measured with an Ultraviolet Pyranometer and recorded on a data logger at 3 - minute intervals.

C. Effect of Bt on non-target Lepidoptera

Studies continue in the laboratory and field to evaluate the effects of Bt on the larvae of non-target Lepidoptera. In the laboratory, larvae of 41 species have been evaluated to determine their fate following the consumption of Bt-treated foliage. Larvae were evaluated in the instar in which they would occur in the field at the time of a typical Bt application. Over 80% of the species evaluated in early (first of second) instars succumbed to Bt infection, while about 25% of the species evaluated in later instars were susceptible to Bt. We conclude from our laboratory data that Bt susceptibility must be dealt with on a species-to-species basis. This will complicate management decisions involving the widespread use of Bt, particularly where species of "special concern" (threatened, endangered, etc.) are concerned. At present, no data are available concerning the Bt susceptibility of any species in this category.

In the field, we have been monitoring ten 50-acre plots--half of which were treated with Bt in May, 1992--in Rockbridge County, VA. Using foliage sampling and the collection of larvae of non-target Lepidoptera under burlap bands, we collected approximately 10,000 larvae in 1992 and 7,000 larvae in 1993. Comparing the larvae taken in Bt-treated vs. untreated plots, we have recorded what appears to be a treatment effect during only the year of treatment in foliage samples, and a post-year treatment effect for certain species in the burlap samples. Although massive amounts of data remain to be analyzed, preliminary results suggest that although reductions did occur in the Bt treated plots, the change in numbers were not dramatic not was any species or family of Lepidoptera eliminated by the treatment. We are also using light traps to monitor populations of adult moths in treated and untreated plots.

C. General

1. We continue to support research at Penn State and the University of Connecticut through participation with the Northeast Forest Aerial Application Technology Group (NEFAAT) and assistance from WO-FPM and NA-FHP. Dr. Karl Mierzejewski is involved in several NEFAAT-related studies to evaluate the use of GPS in aerial application, and a mini-lidar to track pesticide drift over forested areas. Karl also conducted a study in Michigan to assess the distribution of GYPCHEK

deposits on foliage as part of the field evaluation that occurred in that state.

Dr. David Miller headed up the LIDAR study in Pennsylvania in cooperation with specialists from the Los Alamos Laboratory and has prepared a proposal to acquire LIDAR and SODAR instrumentation for use in measuring drift of aerially applied pesticides.

2. We completed a modelling study with Dr. David Miller, funded through the Asian Gypsy Moth R&D Program, to assess the probability that windblown, newly-hatched Asian Gypsy Moth larvae, emerging from infested ships in the port of Tacoma could have served as the source for male moths that were trapped in Washington in 1991. An abstract of a manuscript prepared as a result of that study is included for this report.

ESTIMATES OF WINDBLOWN DISPERSAL OF NEWLY-HATCHED ASIAN GYPSY MOTH LARVAE FROM INFESTED SHIPS IN THE TACOMA PORT FACILITY

D.R. Miller, M.A. McManus, B.L. Connell and V. Mastro

ABSTRACT

Probable travel directions and distances were estimated for wind blown Asian Gypsy Moth larvae released from the Tacoma port facility. Probabilities were estimated from the historic records of wind speed and direction measured at the Seattle-Tacoma airport. Possible patterns of larval dispersion were estimated using a numerical topographic wind model (NEWATMOS) and a gaussian puff dispersion model (CITPUFF) from the US Forest Service Topographic Air Pollution System (TAPAS). The calculations indicated that there is a very small, but finite, possibility that a few larvae released from ships in the harbor could travel up to 22 km in a NW direction. There is a very high probability that larvae released from a ship in the port will be blown only a few meters with all being deposited in less that 500 m distance.

3. Two teams of two scientists from NEFES visited institutes in Romania and Siberia to facilitate opportunities for biological control of the gypsy moth in North America. Isolates of entomopathogens from geographically distinct gypsy moth populations in both countries were recovered and returned to the Ansonia quarantine facility for evaluation and future consideration as classical biological control agents.

STUDY ABSTRACT

Study No.: 4500-FS-NE-4502.35 /X/Cooperative Study

Study Title: Evaluation of Gypchek formulations applied aerially against gypsy moth populations in Michigan.

Study Location: MI State Forest Lands; Manistee National Forest; Manistee, Mason, Oceana, Wexford, Lake & Newaygo Counties, MI; Hamden, CT; Beltsville, MD.

Schedule:

Proposal 3/93	Estimated Completion
Established 3/93	1994

Cooperation: NA S&PF Forest Health Protection, National Center of Forest Health Management; USDA-ARS Insect Biocontrol Laboratory, MI Dept.of Agriculture, MI Dept. of Natural Resources, Manistee National Forest, APHIS, American Cyanamid Company.

Problem: Gypchek is environmentally safe and efficaceous at high dosage but remains costly to produce (ca. $23.00 per acre treatment) and difficult to apply. Thus, commercial development has been slowed and the long awaited integration of this product into gypsy moth management strategies has been delayed.

Objectives:

1. Evaluate and compare the following Gypchek treatments:
   A. Two applications of a wettable powder formulation (standard dose).
   B. Two applications of a wettable powder-optical brightener formulation. (10% standard dose).
   C. One application of a wettable powder-optical brightener formulation. (5% standard dose).
   D. Two applications of a wettable powder-optical brightener formulation (4% standard dose).
   E. No spray (Control)

Methods:

1. Select 30, 30-acre (12-ha) plots, establish 0.025-acre (0.01-ha) subplots, select trees for defoliation estimates, and perform egg mass counts.
2. Perform pretreatment larval counts and collections.
3. Treat plots with Gypchek formulations, aerial applications, fixed wing.
4. Peform posttreatment larval counts and collections.
5. Assess mortality in larval collections.
6. Perform defoliation estimates.
7. Perform posttreatment egg mass counts.
8. Data evaluation (ANOVA)

STUDY ABSTRACT

Study No.: 4500-FS-NE-4502.36 /X/Cooperative Study

Study Title: Evaluation of a Gypchek-adjuvant formulation applied aerially against gypsy moth populations in Michigan.

Study Location: MI State Forest Lands; Manistee National Forest; Manistee, Mason, Oceana, Wexford, Lake, & Newaygo Counties, MI; Hamden, CT; Beltsville, MD.

Schedule:

Proposal 3/93	Estimated Completion
Established 3/93	1994

Cooperation: NA S&PF Forest Health Protection, National Center of Forest Health Management; USDA-ARS Insect Biocontrol Laboratory, MI Dept.of Agriculture, MI Dept. of Natural Resources, Manistee National Forest, APHIS, Entotech, Inc.

Problem: Gypchek is environmentally safe and efficaceous at high dosage but remains costly to produce (ca. $23.00 per acre treatment) and difficult to apply. The easing of application problems depend upon the development of a commercial ready-to-use formulation that will eliminate the labor intensive, time consuming on-site blending of tank mix ingredients.

Objectives:

1. Evaluate and compare the following Gypchek treatments:
   A. Two applications of a spray adjuvant formulation (low dose).
   B. Two applications of a spray adjuvant formulation (high dose).
   C. Two applications of the standard lignosulfonate-molasses formulation (high dose).
   D. No spray (Control).

Methods:

1. Select 24, 30-acre (12-ha) plots, establish 0.025-acre (0.01-ha) subplots, select trees for defoliation estimates, and perform egg mass counts.
2. Perform pretreatment larval counts and collections.
3. Treat plots with Gypchek formulations, aerial applications, fixed wing.
4. Peform posttreatment larval counts and collections.
5. Assess mortality in larval collections.
6. Perform defoliation estimates.
7. Perform posttreatment egg mass counts.
8. Data evaluation (ANOVA)

Harry Yates

Impact of Small Mammal Predators on Gypsy Moth Populations in Selected Habitats of the Southeast

(Fred P. Hain, Harvey R. Smith and Felton L. Hastings - NCSU)

The original justification for this project was that a long-term study was needed to evaluate the impact of small mammal predators on the spread of gypsy moth. It was hypothesized that natural enemies, especially predators, may serve as the first line of defense against an exotic herbivore. A generalist predator, such as the white-footed mouse, may be present in sufficient numbers in a given ecosystem to prevent the establishment and/or expansion of a gypsy moth population. Sufficient numbers of a predator, however, may depend upon the availability of alternative food sources, such as mast. Other natural enemies, such as invertebrate predators, parasites and diseases, may also be a factor in preventing the establishment of a gypsy moth population.

Results to date have shown that extreme yearly oscillations in small mammal populations can occur.

The 1992 survey data of the permanent plots clearly demonstrate extreme regional variations. Although the mouse population in the Coastal Plain (Northampton and Currituck Cos.) remained relatively low during the year, the Mountain (George Washington National Forest) populations were very high and the Piedmont (Lake Anna) populations were moderate in May and very high in July. At the leading edge, small mammal predators that are already part of the ecosystem may represent the first line of defense against the invading gypsy moth. The importance of predators in containing the spread of gypsy moths at the leading edge has not been adequately studied nor appreciated.

Twenty-six cadavers from the two mountain sites were sent to John D. Podgwaite of the U.S. Forest Service, Hamden, CT, and 25 were infected with the fungus Entomophaga maimaiga, and the other with a virus.

Gypsy Moth Observations on the Withlacoochee State Forest, 1993

(J.L. Foltz and W. Dixon U. Florida)

The objective of this research study was to learn how Florida weather, host trees, and natural enemies affect development and survival of the gypsy moth to the adult stage.

F1 sterile eggs were obtained from Vic Mastro, USDA APHIS Otis Methods Development Center. Male pupae irradiated in July & August 1992. These males mated with normal females to produce sterile offspring. Eggs stored in Massachusetts screenhouse for required exposure to winter chill before shipment to Florida.

Twenty-eight to 30 screen bags containing 500 grams (Feb 22) and 350 grams (Mar 22) of eggs were stapled on tree trunks on each of 3 plots. Assuming a hatch of 400 larvae per gram, each plot started with 340,000 larvae. For plots

of 4 to 7 acres, the initial density ranged from about 50,000 to 85,000 larvae/acre.

Burlap bands and pheromone traps were used to monitor development and compare abundance among the plots.

APHIS PPQ put out "delimitation traps" on April 29 on a one-half mile grid surrounding the research plots. Traps checked every 2 weeks and pulled on July 8. One moth found on May 25 and 3 moths (one each in 3 traps) on June 8.

Results support the hypothesis that central Florida is a poor place for the gypsy moth. The few caterpillars observed at the burlap bands suggests substantial mortality shortly after hatching, likely due to the scarcity of acceptable foliage. The unusual freeze of March 15 exacerbated this shortage by killing the new foliage on some acceptable hosts. The scarcity of larval and pupal parasites was surprising given the high parasitism commonly observed in collections of tussock moths and tent caterpillars (Orgyia spp, Dasychira spp., and Malacosoma spp.). No vertebrate predation was observed during our weekly checks of the plots, but lizards seen on tree trunks and under burlap bands might consume substantial numbers of larvae and adults.

The first release of F1-sterile gypsy moths in Florida demonstrates the utility of sterile insects for assessing the consequences of unwanted introductions of pest species. Future work should use more eggs on more and smaller plots to increase the likelihood of recovering larvae and pupae for observations of gypsy moth natural enemies.

Sheri Smith

REPORT TO: NATIONAL STEERING COMMITTEE
GYPSY MOTH AND EASTERN DEFOLIATORS
31 AUGUST- 1 SEPTEMBER 1993

SUBMITTED BY: SHERI L. SMITH
REGION 5

In 1993 17,550 gypsy moth traps were placed throughout the state of California. State of California, Department of Food and Agriculture has the lead on trap deployment throughout the State. As of August 26, 1993, 12 (twelve) European gypsy moths catches have been confirmed. The following table lists the catches by county and city:

County	Adults trapped
Alameda	3
Albany (3)	
Los Angeles	2
Downey (1)	
Montebello (1)	
Mariposa	1
Wawona (1)	
Orange	3
Anaheim (1)	
Irvine (1)	
Newport Beach (1)	
San Diego	1
Serra Mesa (1)	
Santa Clara	1
Saratoga (1)	
Shasta	1
Redding (1)	
Total	12

Harold Thistle

Missoula Technology and Development and FPM

Prepared by:

Harold Thistle
406-329-3981

August 30, 1993

Missoula Technology and Development Center (MTDC) and Forest Pest Management (FPM) developed a five year work plan which began in FY92 and includes both specific development tasks to be accomplished by MTDC for FPM and general technical support of FPM programs by MTDC.

I. Technical Services

Bacillus Thuringiensis - Drift/Dispersion and Effects on Non-Target Lepidoptera, Utah 1993 Phase III

Sugar Pine Sprinkler (Diane Herzberg)

Gypsy Moth Larvae Survival Study (Mark Quilter)

Technical Meeting Presentations:

American Institute of Chemical Engineers

Air and Waste Management Association/American Meteorological Society

American Society of Agricultural Engineers

Second International Symposium on Pesticide Application Techniques

Society of Environmental Toxicology and Chemistry

II. Technical Transfer of Computer Models

Droplet Evaporation

Complex Terrain

III. Aircraft Guidance

Evaluate GPS Technology

Catalog and Recommend Technology

IV. Block Marking Methods Guide

Guide

Recommend GPS Technology

V. Characterizing Spray from Ground Sprayers

Review Existing Computer Models

Design Model Evaluation (Review Existing Designs)

Conduct Model Evaluation

VI. Ground and Aerial Pheromone Applicator Evaluation
(Diane Herzberg)

VII. Thermal Insect Control
(Keith Windell)

Jeff Witcosky

CHARACTERIZATION OF HARDWOOD FOREST CANOPIES IN THE EASTERN U.S.

A FPM TECHNOLOGY DEVELOPMENT PROJECT PROPOSAL

Project Status: New, not previously funded.

Project number: R8-93-07

Project title: Characterization of Canopy Leaf Area Profiles for the Major Deciduous Forest Types in the Eastern United States.

Subject: Eastern Defoliators

Project objective: This project proposes to characterize canopy leaf area profiles for fifteen major hardwood forest types in the eastern United States. These data would be consolidated into a digital canopy library of forest types and would be incorporated into the pesticide spray computer model, FSCBG. Model users would be able to access the canopy library and select a forest type directly while running FSCBG. Once a forest type is selected by the user, FSCBG would access the library and select the appropriate canopy characteristics to use during the model run. FSCBG would then estimate the deposit of spray material directly on the selected forest canopy.

Brief description of project: The canopy leaf area profile project proposes to characterize the leaf area profile for fifteen major hardwood forest types in the eastern United States. Typical stands would be selected from long-term ecological study sites, federal lands, state lands, and private lands. A Licor LAI-2000 Plant Canopy Analyzer would be raised vertically through the forest canopy; measurements of light penetration (which are numerically converted to leaf area by the Licor software) would be obtained at two meter intervals (Wang et al., 1992). A minimum of five sample profiles would be taken per stand. Additional stand data would be obtained including, species composition, diameter at breast height, tree height, basal area, stand age, stand density, and site index. The stand and canopy data would be condensed into a digital canopy library which can be incorporated as computer code into FSCBG. This addition to FSCBG would permit easy modeling of spray deposit on a forest canopy without requiring that a user have extensive knowledge of the forest's canopy architecture. FSCBG could automatically access the data set associated with the user-specified stand during the process of estimating spray deposit.

FPM person who will lead the project: Jeffrey J. Witcosky, Entomologist, Region 8, Asheville Field Office, located at the George Washington National Forest, Harrisonburg, VA.

Justification: It is generally recognized that the amount of material deposited on the foliage determines, to a very large extent, whether control of the target insect is successful. However, measuring the appropriate attributes of a forest canopy is difficult and time consuming. The acquisition of a forest canopy library for FSCBG would simplify the process required to predict the deposit of spray material directly on a target canopy and would require that a user have knowledge of only a few standard forestry measurements of that stand. A canopy library would add to the general utility of FSCBG, provide much more realistic applications for users, and permit further additions to FSCBG including options for predicting the degradation, persistence, and environmental fate of insecticides and for predicting treatment impacts on target (and non-target)

insects. The canopy profile library addition to FSCBG would enhance the decision making process of pest management specialists by improving their ability to evaluate how environmental conditions limit successful spray applications.

Urgency: The National Spray Model Advisory Committee recommended that a canopy library be acquired and incorporated into FSCBG. With the acquisition of a canopy library, the USDA Forest Service would be able to provide a more flexible version of FSCBG to individuals planning operational control projects, establishing regulatory criteria, and conducting research studies.

Scope of Application: The canopy profile library would have widespread application throughout the United States and Canada. Specifically, a version of FSCBG with the canopy library may be used by state and federal pest management specialists to predict the deposit of spray material on deciduous forest canopies during insect suppression projects in the eastern United States. The canopy library also could be expanded to cover other hardwood forest types and coniferous forest types in the United States and Canada. The library would be of value as long as FSCBG and subsequent models are in use.

Measure of success: The canopy profile project would be considered a success if a canopy profile library is acquired and used with future versions of FSCBG.

Link to national FPM technology development steering committee priorities: This project was included under "Priority 2--Enhance FSCBG for total accountancy of pesticide sprays and interface with environmental fate and impact models" by the the National Spray Model Advisory Committee at their 1992 meeting in Charlotte, NC (Barry 1992). This canopy leaf area profile technology development proposal is an outgrowth of the sub-committee on canopy characterization established by the National Steering Committee for Management of Gypsy Moth and Eastern Defoliators (Barry 1992, 1991).

Research basis: This project proposes to implement the research findings of Dr. Wang et al. concerning the measurement of canopy leaf area profiles using the Licor LAI 2000 sensor (Wang et al. 1992). Forest canopies can be sampled nondestructively and characterized for canopy leaf area using a Licor 2000 Leaf Area Analyzer (Gower and Norman 1991, Welles 1990, Welles and Norman 1991). The data are recorded digitally on the Licor data logger and are downloaded to a computer where they can be aggregated into a canopy profile data base. The FSCBG model computer code already has been modified to accept Licor data.

Methods: Selected forest stands for fifteen forest types would be sampled during the summer months. The research work of Wang et al. (1992) indicate that as few as five sample profiles would be required to characterize total leaf area of a stand with 90% confidence. At each profile sample site, the Licor sensor would be raised on a platform vertically through the forest canopy. Light penetration data would be recorded on the Licor data pod at two meter intervals. Once a canopy was sampled, the data would be downloaded to a computer as an ASCII file. Standard forestry measurements of stand characteristics also would be obtained for each stand sampled. The stand data base and the Licor data base will be combined into a canopy library of eastern hardwood forest types by staff at the University of Connecticut.

To develop the library, the profiles of leaf area index (LAI) measured in each stand will be fit to a cumulative statistical distribution. The fitting procedure for one oak stand was defined by a Weibull distribution and the

parameters "a" and "b" were determined for that stand. A canopy module within FSCBG could be programmed to solve the statistical distribution when provided with "a" and "b" from the canopy library table which lists the parameters for each stand type.

A small subset of oak stands would be sampled repeatedly prior to flowering and bud swelling in spring and throughout the leaf expansion period; this data set would be used to characterize the initial woody canopy and the expansion process of the canopy leaf area during the leaf-out period. These data would permit users to indicate the extent of leaf expansion during the selection of a stand canopy from the library.

Drs. Yang and Miller would provide training for the technicians in the use of the equipment, Licor LAI 2000, sampling procedures, and data downloading and error checking procedures. Stand and canopy data recorded during the day would be downloaded to a computer that evening and checked for errors.

Cooperators: Drs. Xiusheng Yang and David R. Miller, Department of Natural Resources Management and Engineering, The University of Connecticut, Storrs, CT 06269.

Products: The canopy library would be in a format to incorporate into FSCBG by the end of FY 1995. The entire canopy library would be made available on computer diskette and in a Forest Service publication, if necessary.

Publication: A new version of FSCBG with the canopy library would be provided to all members of the FSCBG user's group. A Forest Service publication would provide additional documentation, if necessary. Data sets would be available on computer diskettes from the investigators upon request.

Literature Cited

Barry, J.W. 1992. National steering committee for management of gypsy moth and eastern defoliators. Fifth Report. FPM 93-2.

Barry, J.W. 1992. National spray model advisory committee. Third report. FPM 92-10.

Barry, J.W. 1991. National steering committee for management of gypsy moth and eastern defoliators. Fourth report. FPM 92-2.

Gower, S.T. and J.M. Norman. 1991. Rapid estimation of leaf area index in conifer and broad-leaf plantations. Ecology 72: 1896-1900.

Wang, Y.S., D.R. Miller, J.M. Welles, and G.M. Heisler. 1992. Spatial variability of canopy foliage in an oak forest estimated with fisheye sensors. Forest Science 38: (in press).

Welles, J.M. 1990. Some indirect methods of estimating canopy structure. Remote Sensing Reviews 5: 31-43.

Welles, J.M. and J.M. Norman. 1991. Instrument for indirect measurement of canopy architecture. Agronomy Journal 83: 818-825.

MESSAGE SCAN FOR BARRY, JACK

To J.BARRY:R05H

From: JEFF WITCOSKY:R08F08A
Postmark: Jun 13,93 1:48 PM Delivered: Jun 13,93 10:47 AM

Subject: HARDWOOD CANOPY PROJECT

Comments:
HELLO, JACK. WELL, WE ARE OFF ON OUR FIRST TRIP TO SAMPLE HARDWOOD CANOPIES AS PART OF THE TECHNOLOGY DEVELOPMENT PROJECT. WE ARE GOING TO START OUT ON THE MONONGAHELA NF AND HOOSIER NF SAMPLING CHERRY-MAPLE AND OAK FOREST COVER TYPES. I HAVE ATTACHED A LIST OF SAF FOREST COVER TYPES AND COOPERATORS FOR YOUR INFORMATION.
I WILL NOT BE ABLE TO MAKE THE SPOKANE MEETING AND HAVE ASKED HAROLD FLAKE TO MAKE A FEW BRIEF COMMENTS FOR ME (AS NEEDED).
BEST WISHES FOR A PRODUCTIVE MEETING. JEFF.

-------========X========-------

11 June 1993

SAF HARDWOOD FOREST TYPES FOR CANOPY LEAF AREA PROJECT

FOREST COVER TYPE	SAF CODE	NATIONAL FOREST OR OTHER AGENCY	CONTACT	DG ADDRESS
Boreal Hardwoods				
Aspen	16	Chippewa NF	Bob Brittain	R09F03A
Pin Cherry	17			
Paper Birch	18	Chippewa NF	Bob Brittain	R09F03A
Balsam Poplar	203			
Northern Hardwoods				
Sugar Maple	27	Nicolet NF	Dick Cutler	R09F06A
		Chequamegon NF	Joe Bondioli	R09F02A
		White Mountain NF/NEFES	Bill Leak Chris Eagar	S24L06A
Sugar Maple-Beech-Y. Birch	25	White Mountain NF/NEFES	Bill Leak Chris Eagar	S24L06A
		Allegheny NF	Bob White	R09F19A
Sugar Maple-Basswood	26	Chippewa NF	Bob Brittain	R09F03A
		Nicolet NF	Dick Cutler	R09F06A
Black Cherry-Maple	28	Monongahela NF/NEFES	Gary Bustamente and Clay Smith	R09F21A R09F21D01A
		Allegheny NF	Bob White	R09F19A
Beech-Sugar Maple	60	White Mountain NF/NEFES	Bill Leak Chris Eagar	S24L06A
Red Maple	108	Hiawatha NF?		R09F10A
		Allegheny NF	Bob White	R09F19A
Northern Pin Oak	14	Chequamegon NF	Joe Bondioli	R09F02A
Gray Birch-Red Maple	19			
Black Ash-Am. Elm-Red Maple	39			
Hawthorn	109			
Upland Oaks				
Post Oak-Blackjack Oak	40	Mark Twain NF /NCFES	Dick Schlesinger	S23A
Bur Oak	42			
Bear Oak	43			
Chestnut Oak	44	Allegheny NF	Bob White	R09F19A
White-Black-Northern Red Oak	52	Allegheny NF	Bob White	R09F19A
		NFs in TX	George Weick	R08F13A
		Hoosier NF	Tom Thake	R09F11A
White Oak	53	Hoosier NF	Tom Thake	R09F11A
Black Oak	110	Huron-Manistee? NF	Rose Ingram	R09F04A

Upland Oaks (continued)

Northern Red Oak	55	Allegheny NF	Bob White	R09F19A
Black Locust	50	Shenandoah NP	Keith Watson	R08F08A
Yellow Poplar	57	Duke Exp. For.	Jud Edeburn	
		NC State Exp. Forest	Larry Jervis	
		NC Dept. For.	Fred White	
Yellow Poplar-W.O.-N. Red Oak	59	Duke Exp. For.	Jud Edeburn	
		NC State Exp. Forest	Larry Jervis	
		NC Dept. For.	Fred White	
River Birch-Sycamore	61			
Silver Maple-American Elm	62			
Sassafras-Persimmon	64			
Pin Oak-Sweetgum	65			

Bottomland Hardwoods

Cottonwood	63			
Willow-Water-Laurel Oak	88	NFs in MS	Bob Taylor	R08F07A
		NFs in TX	George Weick	R08F13A
Live Oak	89			
Swamp Chestnut-Cherrybark Oak	91	NFs in TX	George Weick	R08F13A
Sweetgum-Willow Oak	92	NFs in MS	Bob Taylor	R08F07A
		NFs in TX	George Weick	R08F13A
Sugarberry-Am. Elm-Green Ash	93	NFs in MS	Bob Taylor	R08F07A
		NFs in TX	George Weick	R08F13A
Sycamore-Sweetgum-Am. Elm	94			
Black Willow	95			
Overcup Oak-Water Hickory	96	NFs in MS	Bob Taylor	R08F07A
Water Tupelo-Swamp Tupelo	103			
Sweetbay-Swamp Tupelo-Redbay	104	NFs in FL	Rob Riser	R08F05A
Sweetgum-Yellow Poplar	87	Duke Exp. For.	Jud Edeburn	
		NC State Exp. Forest	Larry Jervis	
		NC Dept. For.	Fred White	

Other Forest Types not Recognized by SAF

Walnut (plantation)	Wayne NF	Phil Perry	R09F11D01A

Appendix C-1

Spray Aircraft

Swath Width

Sub-Committee

United States Department of Agriculture | Forest Service | Washington Office
2121 C Second Street
Davis, CA 95616
PH (916) 551-1715
FAX (916) 757-8383

Reply To: 2150

Date: September 22, 1993

Subject: Spray Aircraft Swath Width Sub-Committee

To: Harold Flake
Bill Buzzard

Thank you for volunteering to co-chair the Spray Aircraft Swath Width Sub-Committee. We discussed the need for this sub-committee at the recent meeting of the National Steering Committee for Managing Gypsy Moth and Eastern Defoliators; however I would like to summarize the situation by listing concerns that have a bearing on the problem:

1 - There is no accepted standard swath width recommended for aircraft used to treat gypsy moth.

2 - USDA-APHIS has a list that recommends swath widths for most aircraft; however the recommendations may not be accepted by others and it is not clear how the swath widths were determined.

3 - Biologists have not specified "effective swath widths" as function of pesticide formulation, aircraft, atomizers, drop size, aircraft speed, etc.

4 - The AGDISP model, extensively tested and published, can accurately predict swath widths as a function of the above variables. There appears to be some hesitancy in using this technology.

5 - The possibility exists that excessive swath width causes poor coverage, low control, and need for retreatment.

6 - Agencies are setting their own swath widths that may be too narrow or too wide for effective coverage.

7 - Field characterization of aircraft is a costly operation with replication between spray runs nearly impossible.

The charge of the sub-committee is to evaluate these listed concerns and develop a report and recommendations for swath widths in gypsy moth control operations. My notes list potential Sub-Committee members to include Dan Twardus and Craig Howard (FPM). As the committee emerges into this problem it undoubtedly will surface

other facts and other concerns. The committee felt a sense of urgency and asks that you provide the draft report and recommendations by December. Thanks again and please call if you need clarification.

John W. Barry

JOHN W. BARRY
Chair

cc: K. Swain
Steering Committee Members

Appendix C-2

Non-Target Sub-Committee

Report - Dick Reardon

United States Department of Agriculture | Forest Service | NA

Reply to: 1350 Date: August 19, 1993

Subject: FY93 Report of Non-target Impact Subcommittee

To: Jack Barry
Chairman, Eastern and Western Defoliator Nat'l Steering Committees

Overview

FY91 -- At the 1991 meeting (September 10-11, Blacksburg, VA) of the National Steering Committee for Managing Gypsy Moth and Eastern Defoliators, three subcommittees were formed: Pilot Training, Non-target Impact, and Canopy Characterization. In a letter (September 17, 1991) you requested that I chair the Non-target Impact subcommittee and include as subcommittee members: Leo Cadogan, FPMI/Canada and Steve Munson, R-4/FPM. In a follow up letter (March 10, 1992) you suggested two additional members: Dave Grimble, R-6/PNW and Dayle Bennett, R-3/FPM, and identified the charge of the subcommittee: to identify what is known and data gaps about the impacts of Bt and diflubenzuron (dimilin) on non-target Lepidoptera, aquatics, birds, and small mammals, and to submit a bibliography and recommendations to the steering committee at the 1992 meeting.

FY92 -- I was unable to attend the 1992 meeting (August 18-19, Albuquerque, NM) of the National Steering Committee for Managing Gypsy Moth and Eastern Defoliators but submitted a letter to you concerning progress by the Non-target Impact subcommittee. As a brief summary of that letter: Leo and I met at FPMI in April 1992 and discussed the need to identify scientists from the U.S. and Canada who would be interested in or were conducting non-target impact studies in forest ecosystems. In July 1992, Leo identified a preliminary group of scientists (list A) which was updated by Steve Holmes (list B). Leo and I intended to select a core group of scientists from list B and meet with them at the Pest Control Forum in Ottawa (November 1992).

Also, initial versions of Dimilin and Bt bibliography databases were developed through the efforts of Munson in association with the University of Utah and Amy Onken (Forest Health Protection, Morgantown) in conjunction with West Virginia University (see attachment). At that time, the databases contained about 700 and 900 citations concerning efficacy and non-target impacts, respectively.

Following the 1992 meetings of the Eastern and Western Defoliator Committees, Steve Munson sent a letter to me stating that 3 additional western representatives (Bruce Hostetler, R-6/FPM; John Wenz, R-5/FPM; and Larry Stipe, R-1/FPM) were selected to participate on the Non-target Impact subcommittee to help identify needs in the West. Steve Munson and I had the impression that these western representativies were added to the original Non-target Impact subcommittee but, in fact, you had intended Steve to chair another subcommittee "Impact of Biological Insecticides on Non-target Organisms" for the Western Defoliator Steering Committee.

In September 1992, I formed a technical review team composed of mostly eastern scientists (list C) to begin to develop guidelines and protocols for a proposed long-term evaluation of regional impacts of Bt and gypsy moth defoliation on selected non-targets in the East. This long-term regional project was proposed in response to data gaps identified during preparation of the EIS for the Appalachian Gypsy Moth Project (AIPM Project) and follow-up meetings with a coalition of environmental groups from Virginia and West Virginia.

FY93 Activities

Both bibliography databases were expanded and now contain approximately 950 and 1,500 citations, respectively. The databases are stored on disk and we are in the process of obtaining a reprint of each citation. The Dimilin database is nearing completion, whereas the Bt database can be expanded to include additional efficacy citations. There are no citations concerning human toxicology in either database.

Leo contacted most of the Canadian scientists from list B and identified a core group of scientists as members of the Non-target Impact subcommittee: Jan Volney, Imre Otvos, Steve Holmes and Kevin Barber.

To the best of our (Munson, Reardon, Cadogan) knowledge, the following is a list of non-target field evaluations involving the aerial application of Bt or Dimilin in forest ecosystems:

United States

East

Bt

* Impact of Bt on canopy and understory Lepidoptera associated with gypsy moth populations in oak-hickory forest in southern Virginia -- Talley/Peacock(Rockbridge CO., VA/NEFES) -- 3rd. year of 3-year effort.

Dimilin

* Impact of Dimilin on selected vert/invert. in closed broadleaved watersheds - conducted in West Virginia -- numerous investigators -- 5th. year of 5-year effort.

West

Bt

- Barry/Whaley/Anhold - Bt-drift/dispersion and effects on non-target Lepidoptera, Utah 1993 Phase III -- 3rd year of 4 -year effort

- Grimble - Impacts of Bt sprays on non-target Lepidoptera in mixed coniferous forests of eastern Oregon -- 2nd year of 3-year effort (NAPIAP funded)

- - Miller/Grimble - Impacts of Bt on non-target Lepidoptera on the Warm Springs Indian Reservation (Oregon) -- 1st year of 2-year effort

- Miller/Lighthart - Effects of large scale use of Bt var. kurstaki on non-target larval Lepidoptera: Cove Junction (Oregon) -- 2nd year of 2-year effort

General Survey

- Miller/Grimble - Survey of resident Lepidoptera populations across the central Cascades as a possible food source for Townsend's big-eared bat -- 1st of 2-year effort

- Kephart (Willimette University)

  - Investigations and literature survey of Region 6 sensitive plant species and potential Lepidoptera pollinators

- Bennett - Survey to determine effects of Bt on non-target moths: Carson National Forest (New Mexico) -- 1st of 3-year effort (WSB population collapsed)

Canada

- Volney - Potential impacts of operational Bt spray on Lepidoptera -- conducted in Saskatchewan -- ? year effort

- Kreutzweiser - Effects of Btk on aquatic microbial activity, detrital decomposition and invertebrate communities -- conducted in Ontario -- 2nd year of 2-year effort

There are several issues which need to be resolved in FY93:

1. The establishment of one or two Non-target Impact subcommittees. We (Munson, Cadogan, and Reardon) propose one Non-target Impact Subcommittee could represent both the Western and Eastern Defoliator National Steering Committees. Reardon would be the chairman of the subcommittee in FY94 in an effort to coordinate this subcommittee's activities with those of the National Center of Forest Health Management. The National Center was created in April 1993 with three major areas of work emphasis: non-target impacts, biological controls, and biorationals. The purpose of the National Center is to accelerate development and applications of environmentally acceptable new technologies to maintain and improve the health of America's trees and forests.

2. Updating (additional/fewer) members on the Non-target Impact Subcommittee . The suggested members and chairman for each region:

West/US

Steve Munson, John Anhold, Chairman
Dave Grimble, R-6/PNW
Dayle Bennett, R-3/FPM
Bruce Hostetler, R-6/RPM
John Wenz, R-6/FPM
Larry Stipe/Nancy Campbell, R-1/FPM

East/US

Richard Reardon, Chairman
John Omer, NA/FHP
John Peacock, NEFES
Sandy Liebhold, NEFES
Jeff Witcosky, R-8/FPM

Canada

Leo Cadogan, Chairman
Jan Volney, For. Can. N. Alts
Imre Otvos, For. Can, Pac & Yu
Steve Holmes, For. Can. FPMI
Kevin Barber, For. Can. FPMI

3. The need for the Non-target Impact Subcommittee to focus its activities on microbial insecticides used to manage defoliators in forest ecosystems. Specifically, the immediate emphasis areas in the West/US is on Btk and in the East/US is on Btk and Entomophaga maimaiga.

4. Identify the objectives of the Non-target Impact Subcommittee .

FY94 Activities

1. Initiate and complete 5-year plan of work which identifies regional priorities (e.g. data gaps) and contains baseline protocols/procedures for conducting non-target evaluations.

2. Publish and continue to update the Dimilin and Bt bibliography databases.

3. Focus efforts on Bacillus thuringiensis kurstaki:

   a. general surveys to obtain baseline data on populations of Lepidoptera (terrestrial and aquatic) for specific ecosystems

b. potential impacts on selected non-targets (e.g. indicator species, T/E species)

- one comparable study established in Western United States, Eastern United States, and Canada.

4. Identify and solicit input from amateur lepidopterists in developing the 5-year plan of work as well as for individual evaluations.

Richard

RICHARD C. REARDON
Program Manager
National Center of Forest Health Management

cc: Munson
Cadogen

Memo to: Steve Holmes
From: Leo Cadogan
Subject: Formation of a working group relating to the study of the effects of Bt on non target organisms.

As promised at our meeting with Dr. R. Reardon on 22/4/92 I contacted a number of people and the following have been identified as either working in the general areas or are interested in participating in such a working group.

Bill Ernst	CWS	Impact on stream invertebrates
Neil Burgess	CWS	Impact on Birds and/or amphibians
Guy Sirois	CWS Moncton	Impact on Fish
Wendy Sexmith	NB Environ	Funding, Regulatory Affairs
Nelson Carter	NB DNR	Funding and Participation
Jim Bendell	U of T Forestry	Impact of Grouse & Small Mammals
Brian Naylar	OMNR Tech Dev. Unit N Bay	Small Mammals
Candid Czuba	" "	"
Ross D. James	ROM	Song Birds
M.I. Bellocq	U of T Forestry	Small Vertebrates
Jan Volney	ForCan Northern Alta	Gen Bt studies in the Prairies
Imre Otvos	ForCan Pac & Yukon	Gen Bt studies on the West Coast

You can forward this list to Dick Reardon with your additions.

LCO

B.L. Cadogan

22/7/92.

Forestry Canada Forêts Canada

(B)

4 September 1992

Dr. Richard Reardon
AIPM Project Leader
USDA Forest Service
180 Canfield St.
Morgantown, West Virginia, USA
26505

Subject: Formation of a working group - Effects of B.t. on non-target organisms

Dear Richard,

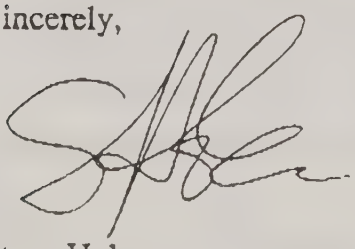
Leo Cadogan has provided me with a list of Canadian researchers who may be interested in participating in a working group on the effects of B.t. on non-target organisms. I have added a couple of names and am passing the complete list on to you.

Bill Ernst	Environment Canada, Halifax	stream invertebrates
Guy Sirois	Fisheries and Oceans Canada, Moncton	fish
Neil Burgess	Canadian Wildlife Service, Sackville	birds, amphibians
Pierre Mineau	Canadian Wildlife Service, Hull	birds, amphibians
Bruce Pauli	Canadian Wildlife Service, Hull	birds, amphibians
Dan Welsh	Canadian Wildlife Service, Ottawa	birds
Jan Volney	Forestry Canada, Northwest Region	general interest
Imre Otvos	Forestry Canada, Pacific & Yukon Region	general interest
Wendy Sexsmith	New Brunswick Department of the Environment, Fredericton	funding, regulatory affairs
Nelson Carter	New Brunswick Department of Natural Resources, Fredericton	funding, general interest
Pierre-Martin Marotte	Ministère de l'Énergie et des Ressources Charlesbourg	persistence, general interest
Ghislain Rousseau	Société de protection des forêts contre les insectes et maladies, Québec	general interest
Brian Naylar	Ontario Ministry of Natural Resources, North Bay	small mammals
Candid Czuba	Ontario Ministry of Natural Resources, North Bay	small mammals
Jim Bendell	University of Toronto	grouse, small mammals
M. Bellocq	University of Toronto	songbirds, small mammals
Ross James	Royal Ontario Museum	songbirds

Canada

I understand that you would like to try to get a group together at the time of the Forest Pest Control Forum in November. I think that this is an excellent idea. If you decide that you want to pursue it, let me know and I will make the necessary arrangements here (book a room, call potential Canadian participants, etc.). Hope to hear from you soon.

Sincerely,



Steve Holmes
Forestry Canada
Science and Sustainable Development
Place Vincent Massey, 21st Floor
351 St. Joseph Blvd
Hull, Quebec
K1A 1G5

Dimilin and Bacillus thuringiensis kurstaki Bibliographies

The National Center of Forest Health Management
Healthy Forests Make A World Of Difference
Technology Transfer

Dimilin and Bacillus thuringiensis kurstaki (Bt) bibliographies are installed and maintained in a computerized database, at the USDA Forest Service National Center of Forest Health Management in Morgantown, West Virginia. Anyone who needs information or data about Dimilin, Bt or both can search these bibliographies, using a Forest Service computerized retrieval program. These bibliographies contain references to efficacy and non-target data but not human toxicology.

The retrieval program allows the user to search for specific articles. A file search may be accessed several ways:

(1) Each field of the database can be searched for all articles that contain a certain value. For example, a search of the field "title" for the value "anni" would find any records that contain "anni" such as Tannins, tannin, or mannitol or the field "year" for 198_ would match records with the years from 1980 to 1989.

(2) To narrow the search, use more than one field. For example, searching the field "year" for "1986" and field "title "for "anni" will find all records for the year 1986 with "anni" in the title.

Any field may be searched for more than one value and any number of fields may be searched. When requesting records please include the fields to searched and the values to be found. Please narrow the search as much as possible.

The records may be printed as a bibliography citation (as for use in preparing a paper) which will not include the abstract, or printed including the abstract.

Searching the Bibliographic Database

The bibliographies have several different fields:

Name of Field	Type of Field and Width
Author	Character (240)
Year	Character (4)
Title	Character (240)
Source	Character (240)
ISSN (National Cataloging System)	Character (25)
NAL (National Agricultural Library)	Character (25)
Language	Character (80)
Abstract	Long

If you have any questions or would be interested in obtaining records from the Dimilin and Bt bibliographic databases, please contact:

Amy Onken
USDA Forest Service
National Center of Forest Health Management
180 Canfield Street
Morgantown, WV 26505
(304) 285-1565
DG Address: S24L08A

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United States Department of Agriculture | Forest Service | Northeastern Area State & Private | 180 Canfield Street Morgantown, WV 26505

Reply to: 1360

Date: September 28, 1993

Subject: Non-target Subcommittee - Western and Eastern Defoliators Steering Committee

To: Jack Barry
Steve Munson

Leo Cadogan and I met on September 26, 1993 in Sault Ste Marie, Ontario to develop an initial plan of action to get Non-target Sub-committee (one sub-committee to represent both the Western and Eastern Defoliator Steering Committees) members moving toward coordinated field and lab activities as well as the development of a 5-year plan. Here are our thoughts:

1) Leo Cadogan and Steve Holmes will be the primary contacts for Canadian activities, and Steve Munson and myself for U.S. activities.

2) Leo and I will send out letters to those identified as actively conducting non-target evaluations or surveys in both countries (mostly complete as prepared for Steering Committee reports but we have identified a few additional researchers) and request a summary of their activities.

3) By December 1993, we will prepare a list of Canadian and U.S. scientists actively involved in Bt non-target studies and provide a summary of their on-going and planned projects. This list will be distributed among all Non-target Sub-committee members.

4) Conduct a conference call (Cadogen, Reardon, Munson, Holmes) in December 1993 to discuss the following:

a) develop a manual of methods/techniques for monitoring and determining impacts on non-targets; would include recommended (common) techniques for all projects.

b) discuss potential joint Canadian/U.S. non-target projects in 1994 and in 1995.

c) initiate a monthly "newsletter" (to be printed out of Morgantown) in an effort to keep all informed of activities.

d) U.S. (Reardon) and Canadian (Holmes) non-target databases will be merged and placed on disk for access by all sub-committee members.

e) identify sources of funding for 1994 and 1995 projects

f) finalize schedule and assignments for development of 5-year plan.

RICHARD C. REARDON
Program Manager
National Center of Forest Health Management

cc: Cadogen
Hatch
Wolfe
Schneeberger

RCR/lfc

Appendix D

1993 Recommendations

Letter to WO/FPM

United States Department of Agriculture | Forest Service | Washington Office | 2121 C Second Street
Davis, CA 95616
PH (916) 551-1715
FAX (916) 757-8383

Reply To: 3400

Date: September 3, 1993

Subject: Recommendations -
Gypsy Moth and Eastern Defoliators

To: Nancy Lorimer

The National Steering Committee for Management of Gypsy Moth and Eastern Defoliators met at Salt Lake City, UT on August 31 - September 1. The purpose of the meeting was to identify Technology Development Program needs and to develop goals and action items for a 5-Year Tactical Plan for Managing Gypsy Moth and Eastern Defoliators. The meeting was productive meeting with active participation by each attendee.

The Committee identified 30 technology development needs and prioritized the list through member voting. Those with the highest priority are listed below along with the number of votes each received.

- Pursue development of a risk model for impact of gypsy moth and control methods on non-target organisms. (13 votes)
- Evaluate impact of gypsy moth and eastern defoliators on forest ecosystems. (9 votes)
- Develop guidelines for surveying and monitoring non-target species. (8 votes)
- Evaluate and recommend guidance, navigation, and monitoring (GIS, GPS, and FSCBG model) systems to guide, navigate, track, and monitor spray aircraft in real-time. (8 votes)
- Determine evaporation rates of Bt tank mixes, under different RH's,that are used to control gypsy moth. (7 votes)
- Develop efficacious pheromone formulation and delivery systems. (7 votes)
- Summarize spray canopy penetration, drift, and behavior in complex terrain, and identify data gaps. (6 votes)
- Investigate a model or expert system that predicts potential for natural collapse of gypsy moth populations. (5 votes)

- Summarize data on the Rohm Haus RH 5992 mimic growth regulator and recommend appropriate field testing. (5 votes)
- Evaluate and/or develop and recommend techniques to physically and electronically mark treatment blocks. (5 votes)
- Test gypsy moth phenology models in the West. (5 votes)
- Continue development of fungal pathogens for gypsy moth. (5 votes)
- Investigate and test Dimilin - reduced rates, reduced volumes, and antievaporants relative to efficacy, economy, drift, and effects on non-target organisms. (5 votes)
- Evaluate effect of Bt on non-target organisms and determine what's at risk. (4 votes)
- Evaluate efficacy and drift of insecticides applied by Rotomist, orchard air blast, and hydraulic sprayers. (4 votes)
- Develop pheromone monitoring procedures for Asian gypsy moth, Nunn moth, and pink gypsy moth. (4 votes)
- Evaluate existing data needed to determine and establish spray buffer zones. (3 votes)
- Summarize data on ultra violet degradation of Bt on foliage. (3 votes)
- Screen western foliage for potential food source of Asian gypsy moth. (2 votes)
- Evaluate registered stickers for undiluted Bt formulations in the laboratory and field. (2 votes)
- Determine ingredients in Bt formulations and evaluate efects of ingredients on non-target organisms. (2 votes)
- Develop reliable detection/collection techniques for female Asian gypsy moth hybrids. (1 vote)
- Develop monitoring techniques for specific native insects that historically reach outbreak levels. (1 vote)
- Determine existing capabilities and future needs for DNA investigation of gypsy moth hybrids. (1 vote)

- Review literature and evaluate statistical analyses methods to support non-target data evaluations. (1 vote)

/s/John W. Barry
JOHN W. BARRY
Chairperson

cc: Committee Members
Jesus Cota
Gerald Hertel

Appendix E

Tactical Plan Memo

United States Department of Agriculture | Forest Service | Washington Office | 2121 C Second Street
Davis, CA 95616
PH (916) 551-1715
FAX (916) 757-8383

Reply To: 2150

Date: August 2, 1993

Subject: 5-Year Tactical Plan

To: Members -
Western Defoliator Committee
Gypsy Moth and Eastern Defoliators Committee

The purpose of this memorandum is to share discussions from the National Steering Committee for Management of Seed, Cone, and Regeneration Insects in preparation of our forthcoming meeting. This committee met at Placerville, CA June 29-July 1. As my previous memorandum indicated our forthcoming meeting will focus on developing a 5-Year Tactical Plan. I believe the scope, format, and processes discussed at the seed, cone, and regeneration insect committee meeting could easily be applied to the other committees and in the process save time in developing the Plan. I hope you agree and will also give some thought on how the proposed scope and format of the 5-Year Tactical Plan, outlined herein, might be improved.

We developed 6 Categories or functional areas, thanks to Nancy Rappaport's efforts, that I believe cover all areas of concern to the committees. These are as follows:

- Basic Biological and Taxonomic Information
- Impact Assessment
- Monitoring
- IPM Situation/Decision Models
- Control Strategies
- Technology Transfer and Training

At the referenced meeting we noted that there is an element of research, development, and technology transfer in each of the 6 categories thus a dual FIDR/FPM role. After listing these categories, reviewing the 1992 committee report, and hearing individual committee reports, we identified needs within a 5-year feasible horizon for completion. From the list of 20 needs we agreed on the 7 most urgent needs and prepared Goal Statements. The goal statements were simply the need, rephrased into future state of being.

Goal statements will be the foundation of our 5-Year Tactical Plans and each goal will fit into one of the 6 categories, or expressed in another way, each fits within the scope of the FPM Technology Development Program. In some cases a Goal may be a basic research item and not a likely candidate for FPM Technology Development. Nevertheless it's important to lay all needs on the table, sort and list, and finally identify those that are candidates for FPM Technology Development funding. Some goals may be addressed and funded in part by other sources (e.g. FIDR or Timber Staffs), Forest Health Institute, Stations, or Regions. In this process we hope to have a road map, and a rational and coordinated approach that's well communicated.

Following the goal statement and background information, we will prepare a list of Actions that follow a logical sequence from year 1 through year 5. The action item is what will be done within a designated calendar year and the title or subject of an FPM Technology Development Project. In reality the action item serves as an invitation for an FPM scientist to submit a proposal. The action items will likely be divided into Sub-Actions or Strategies and be updated annually.

It will be the responsibility of the committees to update the 5-Year Tactical Plan at their annual meeting. Yet to be clarified, however, is the process of managing other aspects of the 5-Year Tactical Plans.

Admittedly what I have outlined is somewhat of an idealistic approach but with your enthusiastic support and hands-on participation, I believe the approach is feasible and an important step toward the continued advancement of the FPM Technology Development Program.

Please share your comments with me and Nancy Lorimer, meanwhile I look forward to meeting you at our forthcoming meeting.

JOHN W. BARRY
Chairperson

cc: Committee Members - National Steering Committee
for Seed, Cone, Regeneration Insects
Dave Johnson
Nancy Lorimer